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NATIONAL DAM INSPECTION PROGRAMS. ALCOA DAM, DNI NUMBER PA-493.--ETC(U)
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OHIO RIVER BASIN
LITTLE CHARTIERS CREEK, WASHINGTON COUNTY

PENNSYLVANIA

ALCOA DAM
NDI No. Pa. - 493

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM.

"Alcoa" Dam, DNI Number "" PA-493. Ohio River Basin, Little Chartiers Creek, Washington County, Pennsylvania. Phase I Inspection Report.

PREPARED FOR

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

PREPARED BY

GAI CONSULTANTS, INC.
570 BEATTY ROAD
MONROEVILLE, PENNSYLVANIA 15146

JUL[illegible]78

PHASE I REPORT
National Dam Inspection Program

Alcoa Dam

Pennsylvania

Washington County

Little Chartiers Creek

31 May 1978

Inspection Team - GAI Consultants, Inc.
570 Beatty Road
Monroeville, Pennsylvania 15146

Based on visual inspection, past performance, and a brief analysis utilizing available design data, the dam appears to be in satisfactory condition but in need of additional analysis and minor repair.

The facility can pass and/or store a flood of 87 percent of the PMF when flow is confined to the spillway and will pass the PMF with a flow above the dam crest (concrete gravity structure) of about 1 foot. Since the required design flow is the PMF, the spillway is considered inadequate and a more detailed hydraulic and hydrologic analysis is recommended to fully assess the capacity of the outlet system, including considering the effects of the failure of upstream dams on Alcoa Dam.

Overturning does not appear to be a problem under PMF conditions, however, resistance to sliding appears inadequate but cannot be sufficiently evaluated with available data. In addition, some seepage was observed at the base of the structure at a distance between 50 and 75 feet from the spillway along the right abutment. Consequently, additional seepage and stability studies are recommended.

The owner's representative was not familiar with the operation of the mechanical equipment in the pump house. Thus, it is recommended that an operating manual and warning system be available for use in the event of a heavy rainfall or emergency.

In addition, the owner should clear debris away from the spillway to allow for unimpeded flow over the structure and the dam should be inspected on a periodic basis to check for hazardous conditions which might develop.

GAI Consultants, Inc.

Bernard M. Mihalcin

Bernard M. Mihalcin

Date July 21, 1978

Approved:

G. K. WITHERS
Colonel, Corps of Engineers
District Engineer

Date 31 Jul 78

Overview Photograph of Alcoa Dam

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Alcoa

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
ALCOA DAM
NDI# PA-493, PENNDER# 63-53

SECTION 1
GENERAL INFORMATION

1.0 Authority.

The Dam Inspection Act, Public Law 92-367 authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

1.1 Purpose.

The purpose is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Alcoa Dam is a concrete gravity structure approximately 525 feet long and 45 feet high. A concrete ogee-crested spillway, 225 feet wide, located approximately 50 feet from the left abutment, discharges into Little Chartiers Creek. During the visual inspection of the dam, a 4-inch diameter blow-off pipe was discharging directly onto the spillway. However, a representative of the Pennsylvania Fish Commission, which presently owns the dam, was unable to provide information regarding the condition and operability of the outlet works as shown on the construction drawings.

b. Location. The dam is located in Washington County on Little Chartiers Creek adjacent to Donaldsons Crossroads which is approximately 3/4 mile to the east. The structure is shown on the U.S.G.S. 7.5 minute quadrangle sheet, Canonsburg, Pennsylvania, and can be located at coordinates N40° 15' 30" and W80° 7' 55".

c. Size Classification. Intermediate (45 feet high, 820 acre-feet storage capacity at spillway crest).

d. Hazard Classification. High (Ref: Section 3.1.c.4).

e. Ownership. Pennsylvania Fish Commission
R. D. #2, Box 39
Somerset, Pennsylvania

f. Purpose of Dam. Recreation (currently); (formerly utilized as a water supply for a defense plant during World War II).

g. Historical Data. Located across Little Chartiers Creek in Peters and North Strabane Townships, Washington County, Pennsylvania, Alcoa Dam was built in 1943 by Alcoa for the Defense Plant Corporation. The dam was constructed solely for the purpose of supplying water to Alcoa's Canonsburg Forging Plant during World War II.

The end of the war brought to a close the operations of the plant which the dam served. Both the plant and the dam were sold as a package in 1950 to the McGraw Electric Company. In 1955, the dam and reservoir were donated to the North American Wildlife Foundation, Inc., of Washington, D. C. Local pollution and a series of private developments along the shore prevented the immediate development of the area as a park. In 1958, the State of Pennsylvania bought the dam and reservoir and placed it under the administration of the Pennsylvania Fish Commission.

1.3 Pertinent Data.

a. Drainage Area. 46.0 square miles.

b. Discharge at Dam Site.

Maximum Known Flood at Dam Site - Data not available.

Maximum Discharge of Spillway ≈ 32,500 cfs (head at elevation 929).

c. Elevation (feet above mean sea level).

Top of Dam - 929.

Maximum Pool Design Surcharge - 928.

Maximum Pool of Record - 921.5 (based on high water mark; no date).

Normal Pool - 918.

Upstream Portal Invert Outlet Conduit - 898.6.

Downstream Portal Invert Outlet Conduit - 905.

Streambed at Centerline of Dam ≈ 884.

Maximum Tailwater - 901.6 (based on high water marked on pump house; no date).

d. Reservoir.

Length of Maximum Pool ≈ 2.0 miles (elevation 929).

Length of Normal Pool ≈ 1.5 miles (elevation 918).

e. Storage (acre-feet).

Spillway Crest ≈ 820.

Top of Dam ≈ 1841.

Design Surcharge ≈ 1770.

f. Reservoir Surface (acres).

Spillway Crest ≈ 75.5 (elevation 918).

Top of Dam ≈ 133 (elevation 929).

Maximum Design Pool ≈ 125 (elevation 928).

g. Dam.

Type - Concrete gravity.

Length - 525 feet.

Height - 45 feet.

Top Width - 7 feet.

Side Slopes - Upstream is vertical to earth surface; downstream 7.6H:10V.

Foundation - The structure is keyed into rock at its base from abutment to abutment.

Grout Curtain - A formal grouting program was not contained in the original specifications according to pre-construction reports. The rock formation indicated that leakage might develop beneath the non-overflow sections of the dam especially adjacent to the spillway where the foundation is stepped up. Consequently, an ad-hoc grouting program was instituted during construction and its progress

can be followed by referring to bi-monthly construction progress reports available from PennDER files (see Figure 5 for grout hole locations).

h. Outlet Conduit.

Type - Available drawings indicate a 4-inch diameter cast iron blow-off is connected to the main intake. This conduit serves to regulate flow downstream during periods of low reservoir level (see Figure 4).

Additionally, a 14-inch cast iron supply line is connected to the facility's pumps. This line formerly supplied water to nearby Western Hospital located in Canonsburg. The line apparently has not been in service for many years. The owner was not sure if the line is still operable.

Closure - A valve on the blow-off is apparently located in the pump house.

Access - Walk-in.

Regulating Facilities - The complete operation of the outlet works could not be ascertained during the inspection or through subsequent research. However, it is assumed that all regulating facilities are located within the pump house.

i. Spillway.

Type - Concrete ogee-crested weir.

Length - 225 feet.

Crest Elevation - 918 feet.

Upstream Channel - Not applicable.

Downstream Channel - Spillway discharges into a small plunge pool and directly into the stream. No downstream spillway channel is associated with this spillway.

j. Regulating Outlets. Operational procedures are unknown. Outlet works are depicted on contract drawings (Figure 4).

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Data Available.

1. Hydrology and Hydraulics. Information available includes storage capacity versus elevation curve, surface area versus elevation curve, spillway head versus discharge curve, all of which are contained within PennDER files. Also included in these files are a set of rough calculations placed on regular tablet paper. The calculations are apparently a preliminary set because a date is set directly on the first page that states when revised calculations were to be submitted. Many ambiguities exist between these calculations and the available contract drawings. However, they are quite useful in checking the methods of design that were utilized. In addition to this information, miscellaneous design notations and data are interspersed throughout the contract drawings.

2. Foundation. A brief stability analysis is included in the calculations which considers both conditions of sliding and overturning. No design reports are available.

3. Appurtenant Structures. Structural design analyses were not available.

b. Design Features.

1. Gravity Dam. Alcoa Dam is a concrete gravity structure with a foundation keyed into rock consisting primarily of shale and limestone (see Photographs 1 through 3). Constructed during World War II as part of a defense plant project, records indicate that specifications were relaxed in order that the dam could be constructed from available materials. The dam has an overall length of 525 feet and a maximum height of 45 feet. The upstream face of the dam is vertical while the downstream face has a slope of 7.6H on 10V from elevation 919.5 to the base. The concrete used in this structure was proportioned to have a minimum compressive strength of 3,000 psi in 28 days.

2. Appurtenant Structures.

a) Spillway. Records indicate that the entire spillway section is founded upon a layer of limestone about 22 feet thick. Beneath the limestone is a dark shale about 12 feet thick which overlies another layer of limestone. The spillway section has a vertical upstream face

while the downstream face is sloped at 8.9H on 10V. A curved apron having a 12-foot radius is located at the bottom of the slope. The apron extends about 9 feet beyond the toe.

b) Pump House. The pump house is located at the downstream base of the dam adjacent to the spillway. It is a one-story masonry structure with dimensions 24 feet by 21 feet. Access to this building was not possible during the visual inspection, consequently, all available information concerning the mechanical equipment it houses is shown on the contract drawings (Figure 4).

c. Design Data. The available design data, actually a set of preliminary calculations, does not appear to be dependable due to many dimensions which are inconsistent with the contract drawings. Pre-construction reports, however, state the maximum spillway discharge capacity equals 32,000 cfs based on a coefficient of 3.9, a length of 225 feet, and a depth of 11 feet.

Rough stability calculations were provided which considered uplift over 2/3 of the base area, with high water level at elevation 928 (10 feet above the spillway crest). The analysis shows a sliding factor of 0.697 for the non-overflow section and 0.778 for the spillway section. These translate into safety factors of 1.43 and 1.29, respectively. The basis for these figures are not available and consequently cannot be verified.

2.2 Construction Records.

Construction data available for review included contract drawings, pre-construction reports, and construction progress reports, including photographs. These data are available in PennDER files.

2.3 Operation Records.

No operational records are available.

2.4 Other Investigations.

No post construction reports are available.

2.5 Evaluation.

The available engineering data was considered sufficient to prepare a report for a Phase I investigation.

SECTION 3
VISUAL INSPECTION

3.1 Observations.

a. General. The general appearance of the structure suggests that it is in good condition.

b. Dam. Although the spillway surface was not visible due to discharging water, that which was exposed appeared to be in satisfactory condition. Minor cracking accentuated by the presence of efflorescence was observed on both spillway end walls (see Photographs 1 and 2). Some spalling has taken place in the end walls of the left abutment where there is an apparent lack of general maintenance, probably because of difficult access conditions.

As indicated in Photographs 4 and 5, there is an area extending to the east about 55 to 75 feet from the east end of the spillway where seepage is occurring through and possibly beneath the concrete structure (note the efflorescence at the seepage line). The flow could not be estimated and the ground surface was saturated in the area (note the relatively high vegetation). A french drain has been installed to direct the seepage into the channel downstream of the spillway.

c. Appurtenant Structures.

1. Spillway. The spillway appeared to be in satisfactory condition. There was slight deterioration at the vertical and horizontal joints as evidenced by the breaks in the flow of water at the joints. Much of the spillway surface appeared to be moss covered.

2. Gate House Valves. There was no means to gain access to the pump house during the visual inspection. The valves, pumps, and piping could be observed through windows and appeared to be in good condition. Mr. Buell (Pennsylvania Fish Commission) did not know how to operate the mechanical system. Following phone conversations with Pennsylvania Fish Commission personnel, we learned that the pump house is no longer in operation.

Since there were no mechanical devices observed on the upstream side of the dam, it is believed that all outlets are controlled by the valve system within the pump house.

3. Reservoir Area. The slopes surrounding the reservoir varied from gentle to steep and were sparsely wooded. No signs of slope distress were observed during our investigation.

4. Downstream Channel. The area immediately downstream of the Alcoa Dam is characterized as a narrow rock-lined channel which discharges into Little Chartiers Creek approximately 2,000 feet downstream. The first downstream improvement is a 2-lane bridge located about 1,000 feet downstream of the dam. Two dwellings (only one may be inhabited) are located just northeast on the upstream side of the bridge. The first floor elevation of both of these structures is less than 8 feet above the bridge deck and both are thought to lie within the area which could conceivably be affected by a failure of the structure.

A sewage treatment facility is located approximately 2,000 feet downstream of the dam adjacent to Little Chartiers Creek just east of the confluence with Chartiers Creek. This facility is also believed to be within the area that could be affected by a failure of Alcoa Dam. Based on the above mentioned observations, the facility was given a high hazard classification.

3.2 Evaluation.

Access to the pump house located at the base of the dam was not provided at the time of inspection, consequently, we were not able to assess its operability. The plan dimensions generally corresponded to those found in the field.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Normal Operational Procedure.

According to a representative of the Fish Commission, there are no established operational procedures at the facility. Excess inflow discharges over the spillway and into the Little Chartiers Creek. Initially, the dam was designed and constructed to supply water to a forging plant located about 9,000 feet downstream. Water was apparently conveyed to the plant through a 14-inch cast iron pipe which passes through the dam and into the pump house. From this point, the water passes longitudinally through the spillway, exits through the left abutment, and turns downstream to the north (for details, see Figures 3 and 4).

4.2 Maintenance of Dam.

The dam is maintained on an as-needed basis. Fish Commission personnel are responsible for many aspects of dam maintenance including caulking construction joints and cleaning debris from the spillway. Major maintenance such as patching concrete is reportedly performed on a yearly basis.

4.3 Maintenance of Operating Facilities.

Mr. Buell of the Fish Commission stated that he had no knowledge of the operations of the pump house nor of any maintenance that might be performed on the equipment.

4.4 Warning Systems.

There are no formal warning systems in effect at the facility.

4.5 Evaluation.

Maintenance at the facility is provided on an as-needed basis. There is a general lack of understanding by maintenance personnel of the workings of the pump house.

SECTION 5
HYDROLOGY/HYDRAULICS

5.1 Design Data.

Information provided by the owner relative to hydrologic and hydraulic analysis were adequate and could be checked against calculations developed in Appendix C. Included were a set of calculations placed on regular loose leaf paper pertaining to spillway discharge, uplift, and sliding calculations. These calculations were apparently a preliminary set which were revised and resubmitted at a later date. The revised calculations were not contained within the files received. Other information available included spillway head versus discharge curve, storage area curve, and various design notations interspersed throughout the drawings.

Alcoa Dam was apparently designed to be operated under a maximum head of 10 feet above the spillway. The dam is thus designed to pass 27,604 cfs with 1 foot of freeboard below the top of dam. The designer notes directly on the contract drawings three cases for dam stability were considered.

Case I - 10 feet head on crest, no uplift.

Case II - 10 feet head on crest, 2/3 uplift, maximum at heel, 0 at toe.

Case III - Reservoir empty.

The calculations available were apparently preliminary and contained small ambiguities, however, the content and conclusions are generally similar to those attained in Appendix C.

5.2 Experience Data.

No data relative to the design storm used in the original analysis or data pertinent to spillway evaluation based on past performance are available.

5.3 Visual Observations.

The dam and its appurtenances appeared to be in satisfactory condition.

5.4 Overtopping Potential.

The "PMF Peak Flow" for this watershed was determined based on data supplied by the Corps of Engineers, Baltimore District. Specifically, the data pertains to a stream gage station located on Chartiers Creek at Washington, Pennsylvania. Based on a drainage area of 28.6 square miles the PMF at this location is 27,200 cfs.

Utilizing this data and applying it to the following equation yields a value of PMF for the watershed in this analysis. That is:

$$Q_1 = \left[\frac{D_1}{D_2}\right]^n Q_2$$

where

Q_1 = PMF at Alcoa Dam
Q_2 = 27,200 cfs
D_1 = drainage area of Alcoa Dam
D_2 = 28.6 square miles
n = empirical constant = 0.7.

The value of n chosen for this analysis is 0.7. This value falls between those values recommended by the Corps of Engineers, Pittsburgh District, for comparison of watersheds within the Ohio River Basin. Based on this information, PMF Q = 37,935 cfs.

The total capacity of the spillway based on a head of 11 feet, which is equivalent to the distance at which the spillway crest lies below the top of dam crest, is equal to 32,506 cfs. Due to a lack of information regarding the operating procedures of the outlet pipes, their additional capacity was excluded from the total discharge capacity. A comparison of peak inflow to the maximum discharge shows that some storage volume is required to hold the excess inflow until it can be safely discharged. Based on normal pool elevation 918 and the top of dam elevation 929, the available storage is found to approximately equal 1020 acre-feet which is less than the volume of storage required 8,930 acre-feet. Further calculations indicated that Alcoa Dam will not pass and/or contain a storm in excess of 87 percent of the PMF when the spillway is functioning at maximum efficiency.

Additional analysis was performed with the entire dam being studied as a broad-crested weir with the exception of that portion of its length occupied by the ogee spillway.

It was found that the PMF is discharged while reaching a maximum head above the dam crest of approximately 1 foot. The corresponding discharge is approximately 38,000 cfs.

Since overtopping will not necessarily lead to failure of a concrete gravity type structure such as Alcoa Dam, consideration was given to both overturning and sliding potential. Based on conservative assumptions, the dam was found to be stable under maximum conditions relative to overturning, however, its stability relative to sliding is questionable.

Overtopping of a concrete gravity type dam is usually a tolerable condition when its duration is short. Nevertheless, flow across the downstream face will cause the foundation at the toe to erode, possibly to and beyond a point of imminent failure either by overturning or sliding. Some design allowance should be made in consideration of this type of condition. However, available calculations indicate the dam was designed such that it was not expected to overtop and consequently it is assumed the condition of the downstream toe under flow was not adequately considered.

Calculations in Appendix C indicate safety factors for overturning and sliding to be 1.3 and 0.8, respectively. These safety factors were arrived at and based on conservative assumptions. However, the overall effects of Alcoa Dam being overtopped for an extended time period require a more extensive analysis. In addition, supplemental calculations prepared for the report on Speers Run Dam indicate a potential for overtopping and failure of both dams located upstream of Alcoa Dam. The effects of such an occurrence are dependent on several factors, such as size and timing of simultaneous rainfalls, reservoir levels prior to storm, etc. Nevertheless, the need for simultaneous study of the three dams in question is evident (see Appendix C).

5.5 Spillway Adequacy.

The facility will pass and/or contain 88 percent of the PMF. As a result, the spillway is deemed inadequate but not seriously inadequate.

SECTION 6
EVALUATION OF STRUCTURAL INTEGRITY

6.1 Visual Observations.

a. Dam. Based on visual observations, the dam appeared to be in satisfactory condition. A small amount of seepage was noted to be issuing through and beneath the dam in a zone approximately 55 to 75 feet east of the spillway (see Photographs 4 and 5).

Most of the construction joints have been caulked with bitumen particularly those that exhibited evidence of prior efflorescence. An exception to this was the area to the left of the spillway where numerous cracks and some spalling were observed on the left abutment walls and in the side walls of the plunge pool (see Photograph 3).

b. Appurtenant Structures. Based on the visual inspection, the spillway structure appeared to be in satisfactory condition. Much of the structure was moss covered and some minor leaching of the concrete along the joints was apparent, however, there was no indication of large scale spalling or other types of deterioration.

6.2 Design and Construction Techniques.

a. Dam. No formal design reports were available concerning the dam or techniques used during construction. However, a set of stability calculations and contract drawings were provided by the PennDER.

b. Appurtenant Structures. No specific design data was available concerning the design and/or construction of the spillway except the above mentioned contract drawings.

6.3 Past Performance.

The only record of past performance consists of a set of high water marks (undated) on the upstream and downstream sides of the dam near the right abutment. No other records were available.

6.4 Seismic Stability.

The dam is located in Seismic Zone No. 1 and it is thought that the static and dynamic stability is sufficient to withstand minor earthquake induced dynamic forces. However, no calculations or investigations, etc., were performed to confirm this belief.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The visual inspection and operational history suggests the dam is in satisfactory condition.

There was no evidence of mass deterioration of the concrete observed during the field inspection. No heaving, joint displacement, pattern cracking, or large scale spalls were observed. Some minor cracking and efflorescence was observed in the spillway walls (see Photograph 3) and some slight deterioration of the construction joints was evidenced by breaks in the flow of water as it passed over the spillway (Photograph 3). In addition, the left abutment end wall showed signs of moderate spalling and seepage at the vertical joints. Much of this latter problem was thought to be related to mechanical weathering of the concrete via frost action and long-term chemical dissolution of cement by seepage issuing from the area just downstream of the left abutment.

A small amount of water was observed to be seeping through a horizontal construction joint just east of the pump house. The ground in this area was saturated indicating that some seepage may also be passing through the dam foundation.

Hydraulic and hydrologic calculations indicated that the structure is capable of passing 87 percent of the PMF without being overtopped; consequently, the spillway is considered inadequate. In addition, the calculations indicate the structure will pass the PMF with approximately 1 foot of water passing over its entire length (525 feet).

A brief stability analysis was performed in order to consider the potential for overturning and sliding. Based on conservative assumptions, it is concluded that the dam is adequately designed relative to overturning but is marginally designed relative to sliding.

b. Adequacy of Information. The information available was considered sufficient to make a reasonable assessment of the project.

c. Necessity for Additional Investigations. Additional investigations (listed below) are deemed necessary.

d. Urgency. It is suggested that the additional investigation and remedial measures listed below be implemented as soon as possible.

7.2 Recommendations/Remedial Measures.

It is recommended that:

a. The owner should retain the services of a registered Professional Engineer to evaluate the seepage occurring at the base of the structure to the right of the spillway.

b. The owner should enlist the services of a qualified engineer to fully assess the safety against overturning and sliding under PMF conditions as well as perform a detailed hydraulic and hydrologic analysis to more accurately determine the capacity of the outlet works and to assess the effects of a failure of upstream dams on Alcoa Dam.

c. Remedial measures should be implemented to seal all cracks and restore any areas where the concrete has deteriorated. Special emphasis should be given to the area at the left abutment where cracking and spalling has apparently gone on unchecked because of difficult access. Debris and soil which has accumulated on the concrete surfaces in that area should also be removed.

d. The spillway should be cleared of debris to allow unrestricted flow over the structure.

e. The owner should develop an operations manual for use of the outlet works in case of emergency. The on-site representative should be familiar with the manual and operation of these facilities.

f. A formal plan or system should be developed for the warning and/or evacuation of downstream residences in case of emergency.

g. The facility should be inspected on a periodic basis by qualified personnel.

APPENDIX A

CHECK LIST - VISUAL INSPECTION

CHECK LIST
VISUAL INSPECTION
PHASE 1

DAM NAME Alcoa Dam COUNTY Washington STATE PA ID # NDI PA-493 PennDER 63-53

TYPE OF DAM Concrete Gravity HAZARD CATEGORY High

DATE(S) INSPECTION 5-31-78 WEATHER Clear & Sunny TEMPERATURE 70° at 10:00 a.m.

POOL ELEVATION AT TIME OF INSPECTION 918 M.S.L. TAILWATER AT TIME OF INSPECTION 887 M.S.L.

INSPECTION PERSONNEL:

D. L. Bonk
Clyde Buell (PA Fish Commission)
J. P. Nairn
B. M. Mihalcin
D. Niebilo

D. L. Bonk RECORDER

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS

ANY NOTICEABLE SEEPAGE

Slight seepage 55 to 75 feet east of the spillway characterized by water stains about 5 feet up concrete wall from base and soggy, moist ground within a 25-foot radius of the area in questions.

STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS

Right Abutment - Concrete in good condition; abutment placed on gentle slope.
Left Abutment - Concrete in fair condition, many cracks and some spalling. Very wet as water from hillside runs on it. Placed on steep sandstone slope.

DRAINS

Two drains located at lower left and right spillway walls.

WATER PASSAGES

None observed.

FOUNDATION

Not visible - Drawings and report dated 1943 indicate shale and/or limestone foundation, however, the most apparent lithology at site was sandstone evident on the steep left abutment.

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Hairline cracks in random pattern visible along crest. Larger cracks near expansion joints. Cracks on right abutment have been caulked and sealed. Concrete at left abutment appears to be neglected possibly because it is not very accessible.	
STRUCTURAL CRACKING	Left abutment endwall shows large cracks and misalignment.	
VERTICAL AND HORIZONTAL ALIGNMENT	Horizontal Alignment - O.K. Vertical Alignment - Visual check shows no apparent misalignment with the exception of the left abutment endwall.	
MONOLITH JOINTS		
CONSTRUCTION JOINTS	Good Condition - Placed at 39-foot center to center from right abutment. All are caulked and sealed.	
STAFF GAGE OF RECORDER:	Staff gauge shown on drawing is missing. No other recording device visible.	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS

CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT

Not observed.

INTAKE STRUCTURE

None - Intake is a 14-inch pipe which was submerged.

OUTLET STRUCTURE

Small blow-off pipe along lower portion of right spillway wall. Discharging during this visit. Pump house locked during inspection. Owner's representative did not have key or knowledge of the operation of the outlet works. Look through windows showed the pipes and valves to have been recently painted and in visually excellent conditions.

OUTLET CHANNEL

None observed - 4-inch blow-off line discharges directly onto spillway.

EMERGENCY GATE

None visible.

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS

CONCRETE WEIR

225-foot wide with ogee crest. Good condition overall. Discharging during inspection. Moss covered at base. Slight deterioration at vertical and horizontal joints as indicated by breaks in water flow.

APPROACH CHANNEL

Submerged.

DISCHARGE CHANNEL

Bedrock channel narrows from 225 feet at dam to about 90 feet at bridge 500 yards downstream. Partially lined with concrete near spillway end walls.

BRIDGE AND PIERS

None - Right abutment walkway in good condition. Left abutment walkway appears to be in state of neglect due apparently to lack of easy access.

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Not Applicable	
APPROACH CHANNEL	Not Applicable	
DISCHARGE CHANNEL	Not Applicable	
BRIDGE AND PIERS	Not Applicable	
GATES AND OPERATION EQUIPMENT	Not Applicable	

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS

MONUMENTATION/SURVEYS

High water marks on both upstream and downstream faces of concrete. Undated but according to Mr. Buell they existed prior to 1960 when the Pennsylvania Fish Commission took over.

OBSERVATION WELLS

None.

WEIRS

None.

PIEZOMETERS

None.

OTHERS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Gentle along reservoir from right abutment (right looking downstream). Steep along reservoir from left abutment.	
SEDIMENTATION	Submerged - none apparent.	

DOWNSTREAM CHANNEL ID # PA-493 SHEET 8

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Debris all along downstream channel, but probably does not affect the flow significantly. First significant obstruction occurs about 500 yards downstream in the form of a roadway bridge.	
SLOPES	Steep along left side. Gentle to slightly steep along right side.	
APPROXIMATE NO. OF HOMES AND POPULATION	Two dwellings with a rough approximation of 8 to 10 people	

APPENDIX B

CHECK LIST - ENGINEERING DATA

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Alcoa Dam

ID # NDI# PA-493, PennDER 63-53

ITEM	REMARKS	SHEET 1

AS-BUILT DRAWINGS

Not available.

REGIONAL VICINITY MAP

Drawing 17075 "Location Map".
U.S.G.S. 7.5 Minute Quadrangle Canonsburg, Pa.

CONSTRUCTION HISTORY

Prepared by GAI based on available correspondence files.

TYPICAL SECTIONS OF DAM

Drawing 17077 "Plan and Elevation Map".
Drawing 17078 "Typical Sections and Details".
Drawing 17081 West Abutment Detail.

OUTLETS - PLAN Not available.

- DETAILS Drawing 17081 "Pump House and Details".

- DISCHARGE RATINGS Not available.

RAINFALL/RESERVOIR RECORDS Not available.

ITEM	REMARKS	ID # PA-493	SHEET 2

DESIGN REPORTS

Not available.

GEOLOGY REPORTS

Not available.

DESIGN COMPUTATIONS
HYDROLOGY & HYDRAULICS
DAM STABILITY
SEEPAGE STUDIES

Preliminary design calculations available in PennDER files. Including spillway capacity, sliding, and overturning calculations. Various design notes located on contract drawings.

MATERIALS INVESTIGATIONS
BORING RECORDS
LABORATORY
FIELD

Not available.

POST-CONSTRUCTION SURVEYS OF DAM

Not available.

BORROW SOURCES

Not applicable.

ITEM	REMARKS	ID # PA-493	SHEET 3

MONITORING SYSTEMS
None.

MODIFICATIONS
None.

HIGH POOL RECORDS
High water marks located on upstream dam face and downstream on pump house. No dates attached.

POST CONSTRUCTION ENGINEERING
STUDIES AND REPORTS
Not available.

PRIOR ACCIDENTS OR FAILURE OF DAM
DESCRIPTION
REPORTS
None.

MAINTENANCE
OPERATION
RECORDS

Not available.

ITEM	REMARKS	ID # PA-493	SHEET 4

SPILLWAY PLAN — Drawing 17077 "Plan and Elevation"

SECTIONS — Drawing 17078 "Typical Section and Details".

DETAILS

OPERATING EQUIPMENT
PLANS & DETAILS

Drawing 17081 "Pump House and Details".

NDI# PA-493

CHECK LIST ID # PennDER 63-53

HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 46.0 square miles.

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 918 feet (820 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 929 feet (1841 acre-feet)

ELEVATION MAXIMUM DESIGN POOL: 928 feet

ELEVATION TOP DAM: 929 feet

SPILLWAY DATA:

a. Crest Elevation 918 feet

b. Type Ogee-shaped

c. Weir Length 225 feet

d. Channel Length Not Applicable

e. Location Spillover Approximately 60 feet from left abutment.

f. Number and Type of Gates None.

OUTLET WORKS:

a. Type 14-inch diameter intake.

b. Location Right abutment.

c. Entrance Inverts elevation 898.6

d. Exit Inverts 905 @ Left Abutment.

e. Emergency Draindown Facilities Not known. Note: Operational procedure of outworks could not be obtained.

HYDROMETEOROLOGICAL GAGES:

a. Type None.

b. Location -

c. Records -

MAXIMUM NON-DAMAGING DISCHARGE: Not known.

APPENDIX C

HYDROLOGY AND HYDRAULICS

SUBJECT DAM SAFETY INSPECTION
ALCOA DAM

BY JTS DATE 6-6-78 PROJ. NO. 78-501-493

CHKD. BY DLB DATE 6-8-78 SHEET NO. 1 OF 19

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LOCATION (DAM, RESERVOIR, AND WATERSHED)

CANONSBURG, WASHINGTON EAST, WASHINGTON WEST, HACKETT, AMITY, BRIDGEVILLE, PROSPERITY, U.S.G.S. 7.5 MINUTE QUADRANGLE

DAM STATISTICS (REF. 1)

MAXIMUM HEIGHT OF DAM = 45 FT.

DRAINAGE AREA = 46.0 SQ. MI.

STORAGE CAPACITY = 267.5 MIL. GAL.
= 820 ACRE-FT

SIZE CLASSIFICATION

DAM SIZE = INTERMEDIATE (REF. 2, TABLE 1)

HAZARD RATING = HIGH (REF. 2, TABLE 2)

REQUIRED SDF = PMF (REF. 2, TABLE 3)

REF. 1: INSPECTION REPORT, WATER AND POWER RESOURCES BOARD, 6-3-46

REF. 2: "RECOMMENDED GUIDELINES FOR SAFETY INSPECTION OF DAMS", DEPT. OF ARMY - APPENDIX D

SUBJECT DAM SAFETY INSPECTION
ALCOA DAM

BY DLB DATE 7-18-78 PROJ. NO. 78-501-493

CHKD. BY JPN DATE 7-20-78 SHEET NO. 2 OF 19

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$$Q_1 = \left[\frac{D_1}{D_2}\right]^n Q_2$$

Q_1 = PMF AT ALCOA DAM

Q_2 = PMF FROM STATION AT CHARTIER'S CREEK (WASHINGTON, PA.)
= 27,200 CFS (SUPPLIED BY CORPS)

D_1 = DRAINAGE AREA AT ALCOA DAM = 46.0 SQ. MI.

D_2 = DRAINAGE AREA AT CHARTIER'S CREEK (WASHINGTON, PA.)
= 28.6 SQ. MI. (SUPPLIED BY CORPS)

n = 0.6 TO 0.8

FOR $n = 0.6$

$$Q_1 = \left[\frac{46.0}{28.6}\right]^n (27,200) = 36,175 \text{ CFS}$$

FOR $n = 0.8$

Q_1 = = 39,782 CFS

ACTUAL Q FROM C OF E CURVE = 42,320 CFS

42,320 CFS > 39,782 CFS > 36,175 CFS

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USE $n = 0.7$ (MEDIAN OF VALUES SUGGESTED BY CORPS OF ENGINEERS, PITTSBURGH DISTRICT)

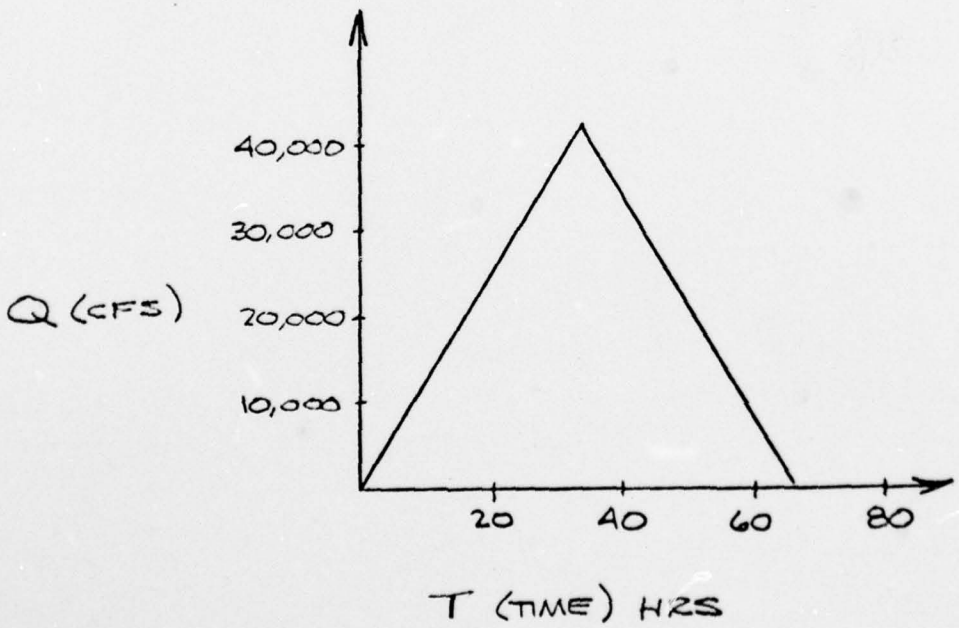
$$Q_1 = \left[\frac{46.0}{28.6}\right]^{0.7} (27,200 \text{ CFS}) = 37,935 \text{ CFS}$$

PMF = 37,935 CFS

DEVELOP INFLOW HYDROGRAPH

MAXIMUM INFLOW = 37,935 CFS

TOTAL TIME OF FLOW = 72 HRS (REF: COE CURVE)



SUBJECT DAM SAFETY INSPECTION
ALCOA DAM

BY DLB DATE 6-20-78 PROJ. NO. 78-501-493

CHKD. BY JPN DATE 7-20-78 SHEET NO. 4 OF 19

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VOLUME OF INFLOW FROM HYDROGRAPH

$V = \frac{1}{2}(Q_{INFLOW})(TIME)$

$= \frac{1}{2}(37{,}935\ CFS)(72\ HRS)(3600\ SEC/HR)(1\ ACRE/43{,}560\ SQ.FT.)$

$= 112{,}864$ ACRE-FEET

DETERMINE THE AVERAGE RAINFALL IN INCHES REQUIRED TO PRODUCE THE ABOVE VOLUME.

$\frac{(112{,}864\ ACRE-FEET)(1\ SQ.MI/640\ ACRES)(12\ IN/FT)}{(46.0\ SQ.MI.)} = 46.0$ INCHES

VOLUMES PRODUCED BY RAINFALLS IN EXCESS OF 26 INCHES ARE TO BE RECALCULATED USING 26 INCHES AS AN UPPER LIMIT.

$(26\ INCHES)(640\ ACRES/1\ SQ.MI.)\frac{(46.0\ SQ.MI)}{(12\ IN/FT)} = 63{,}787$ ACRE-FEET

VOLUME OF INFLOW (RECALCULATED) = 63,787 ACRE-FEET

NOTE: Q_{IMAX} REMAINS CONSTANT.
STORM DURATION DECREASES IN ACCORDANCE WITH THE DECREASE IN INFLOW VOLUME.

STORM DURATION $= [(63{,}787\ AC-FT)(2)(43{,}560\ FT^2/AC)]/(47{,}320\ CFS)(3600\ SEC/HR) = 36.5$ HRS

JECT DAM SAFETY INSPECTION
ALCOA DAM

BY JTS DATE 6-6-78 PROJ. NO. 78-501-493

CHKD. BY DLB DATE 6-8-78 SHEET NO. 5 OF 19

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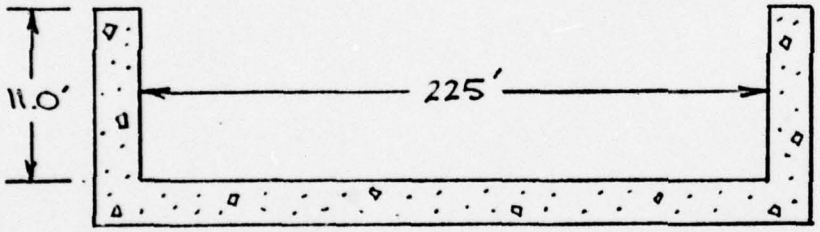
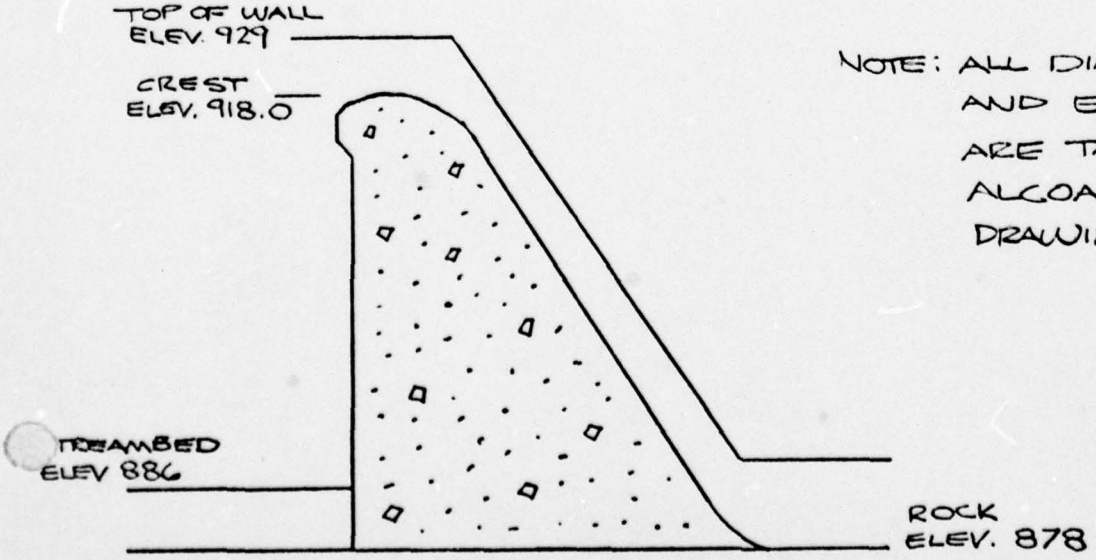
SPILLWAY CAPACITY





NOTE: ALL DIMENSIONS AND ELEVATIONS ARE TAKEN FROM ALCOA CONSTRUCTION DRAWINGS

SUBJECT DAM SAFETY INSPECTION
ALCOA DAM

BY JTS DATE 6-6-78 PROJ. NO. 78-501-493

CHKD. BY DLB DATE 6-8-78 SHEET NO. 6 OF 19

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$Q = CLH^{3/2}$ (REF. 3, EQ. 21-121)

$L = 225'$
$H = 11.0'$

$P/H_D = 32'/11.0' = 2.91$

$\therefore C = 3.96$ (REF 3, FIG 21-67)

$Q = (3.96)(225')(11.0')^{3/2}$

$Q = 32506$ CFS

PMF (PEAK INFLOW) > MAXIMUM SPILLWAY DISCHARGE
37935 CFS > 32506 CFS

REF. 3: "STANDARD HANDBOOK FOR CIVIL ENGINEERS", SECOND EDITION, 1976, McGRAW-HILL

SUBJECT DAM SAFETY INSPECTION
ALCOA DAM

BY JTS DATE 6-6-78 PROJ. NO. 78-501-493

CHKD. BY DLB DATE 7-20-78 SHEET NO. 7 OF 19

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CONSIDER INFLOW RELATIVE TO BOTH OUTFLOW AND STORAGE USING SHORT CUT METHOD AS RECOMMENDED BY NAD

$$P = \frac{\text{MAXIMUM SPILLWAY DISCHARGE}}{\text{PMF PEAK INFLOW}} = \frac{32506}{37935} \quad \begin{matrix}(\text{SHEET 6}) \\ (\text{SHEET 3})\end{matrix}$$

$P = .86$

$$(1-P) = \frac{\text{REQ'D RESERVOIR STORAGE}}{\text{VOL. OF INFLOW HYDROGRAPH}} = (1-.86) = .14$$

VOL. OF INFLOW HYDROGRAPH = 63,787 ACRE-FT (SHEET 4)

REQ'D. RESERVOIR STORAGE = (0.14)(63,787 ACRE-FT)

= 8,930 ACRE-FT

APPROXIMATE AVAILABLE STORAGE (REF. DWG. NO. 63-53)

CAPACITY AT ELEV. 918.0 = 267.5 MIL GAL
CAPACITY AT ELEV. 929.0 = 600.0 MIL GAL

STORAGE AVAILABLE = (600 MIL GAL - 267.5 MIL GAL)

= 332.5 MIL GAL

JECT DAM SAFETY INSPECTION
ALCOA DAM

BY JTS DATE 6-6-78 PROJ. NO. 78-501-493

CHKD. BY DLB DATE 7-20-78 SHEET NO. 8 OF 19

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STORAGE AVAILABLE = 332.5 MIL GAL

= 1020 ACRE-FT

STORAGE REQUIRED > STORAGE AVAILABLE
8,930 AC-FT > 1020 AC-FT

CONCLUSION: ALCOA DAM CANNOT PASS AND/OR CONTAIN THE PMF WITHOUT OVERTOPPING

SUBJECT DAM SAFETY INSPECTION
ALCOA DAM

BY DLB DATE 6-20-78 PROJ. NO. 78-501-493

CHKD. BY KHK DATE 6-21-78 SHEET NO. 9 OF 19

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ESTABLISH WHAT PERCENT PMF AND/OR SDF THE DAM WILL CONTAIN AND/OR PASS

$$P = \frac{\text{MAX. DISCHARGE RATE}}{Q_{I_{MAX}}} = \frac{32,506 \text{ CFS}}{Q_{I_{MAX}}} \quad \text{(SHEET 6)}$$

$$1-P = \frac{\text{AVAILABLE STORAGE VOLUME}}{\text{VOLUME OF INFLOW HYDROGRAPH}} \quad \begin{matrix}\text{(SHEET 8)} \\ \text{(SHEET 4)}\end{matrix}$$

$$1 - \frac{32506 \text{ CFS}}{Q_{I_{MAX}}} = \frac{1020 \text{ AC-FT}}{\frac{1}{2}(Q_{I_{MAX}})(36.5 \text{ HRS})(3600 \text{ SEC/HR})(1 \text{ ACRE}/43,560 \text{ FT}^2)}$$

$$1 - \frac{32506 \text{ CFS}}{Q_{I_{MAX}}} = \frac{1020 \text{ AC-FT}}{1.51\, Q_{I_{MAX}}}$$

$$1.51\, Q_{I_{MAX}} - 49084 = 1020$$

$$1.51\, Q_{I_{MAX}} = 50,104$$

$$Q_{I_{MAX}} = 33,181 \text{ CFS}$$

PMF (PEAK INFLOW) = 37,935 CFS (SHEET 3)

$Q_{I_{MAX}} = 87.5\%$ PMF

CONCLUSION: ALCOA DAM WILL PASS AND/OR CONTAIN 87.5% PMF

SUBJECT DAM SAFETY INSPECTION
ALCOA DAM

BY JTS DATE 6-6-78 PROJ. NO. 78-501-493

CHKD. BY DLB DATE 6-8-78 SHEET NO. 10 OF 19

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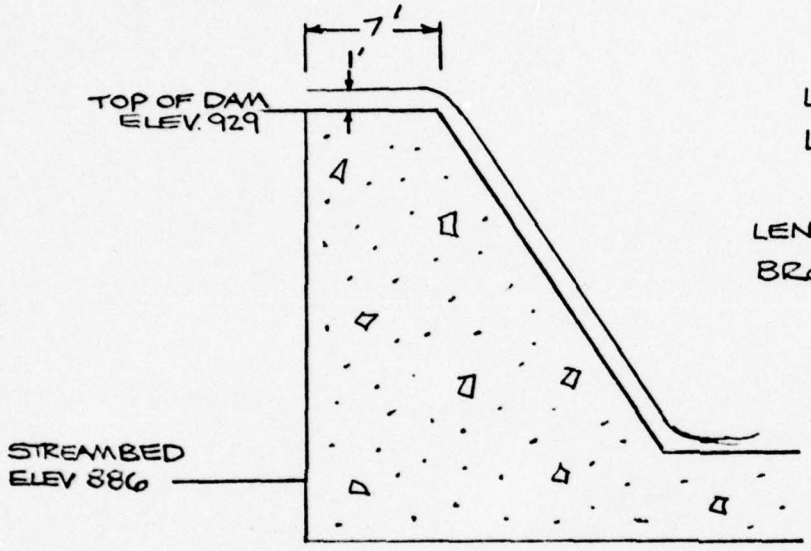
CONSIDER THE ENTIRE DAM AS A BROAD CRESTED WEIR WITH 1 FT. OF WATER FLOWING OVER ITS ENTIRE LENGTH. OMIT LENGTH OF SPILLWAY (CALCULATE SEPERATELY)



LENGTH OF DAM = 525 FT.
LENGTH OF SPILLWAY = 225 FT.

LENGTH OF EFFECTIVE BROAD CRESTED WEIR = 300 FT.

NOTE: DIMENSIONS ARE TAKEN FROM CONSTRUCTION DWG # B17078 F6

$Q_1 = CLH^{3/2}$ (REF. 3, EQ. 21-121)

$L = 300'$
$H = 1.0'$

BREADTH OF CREST OF WEIR = 7.0 FT.

$\therefore C = 2.68$ (REF 3, TABLE 21-15)

$Q_1 = (2.68)(300' \times 1.0')^{3/2}$

$Q_1 = 804$ CFS (OVER BROAD CRESTED WEIR)

SUBJECT DAM SAFETY INSPECTION
ALCOA DAM

BY JTS DATE 6-6-78 PROJ. NO. 78-501-493

CHKD. BY DLB DATE 6-8-78 SHEET NO. 11 OF 19

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CALCULATE Q THRU SPILLWAY WITH 12' HEAD

$Q_2 = CLH^{3/2}$ (REF 3, EQ. 12-121)

$L = 225'$
$H = 12'$

$P/H_D = 32'/12' = 2.67$

$\therefore C = 3.94$ (REF. 3, FIG. 21-67)

$Q_2 = (3.94)(225')(12')^{3/2}$

$Q_2 = 36851$ CFS (OVER SPILLWAY)

TOTAL FLOW = $Q_1 + Q_2 = 804$ CFS + 36851 CFS

TOTAL FLOW = 37655 CFS

PMF (PEAK INFLOW) > MAXIMUM TOTAL DISCHARGE
37,935 CFS > 37655 CFS

SUBJECT DAM SAFETY INSPECTION
ALCOA DAM

BY JTS DATE 6-6-78 PROJ. NO. 78-501-493

CHKD. BY JPN DATE 7-20-78 SHEET NO. 12 OF 19

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CONSIDER INFLOW RELATIVE TO BOTH OUTFLOW AND STORAGE USING SHORT CUT METHOD AS RECOMMENDED BY NAD.

$$P = \frac{\text{MAXIMUM TOTAL DISCHARGE}}{\text{PMF PEAK INFLOW}} = \frac{37655}{37935} \quad \text{(SHEET 11)} \quad \text{(SHEET 3.)}$$

$P = .99$

$(1-P) = (1-.99) = .01 = \frac{\text{REQ'D RESERVOIR STORAGE}}{\text{VOL. OF INFLOW HYDROGRAPH}}$

REQ'D RESERVOIR STORAGE = (.01)(63,787 ACRE-FT)

= 638 ACRE-FT

AVAILABLE STORAGE = 1020 ACRE-FT (SHEET 8)

STORAGE REQUIRED < STORAGE AVAILABLE
638 AC-FT < 1020 ACRE-FT

SUBJECT DAM SAFETY INSPECTION
ALCOA DAM

BY JTS DATE 6-6-78 PROJ. NO. 78-501-493

CHKD. BY DLB DATE 6-8-78 SHEET NO. 13 OF 19

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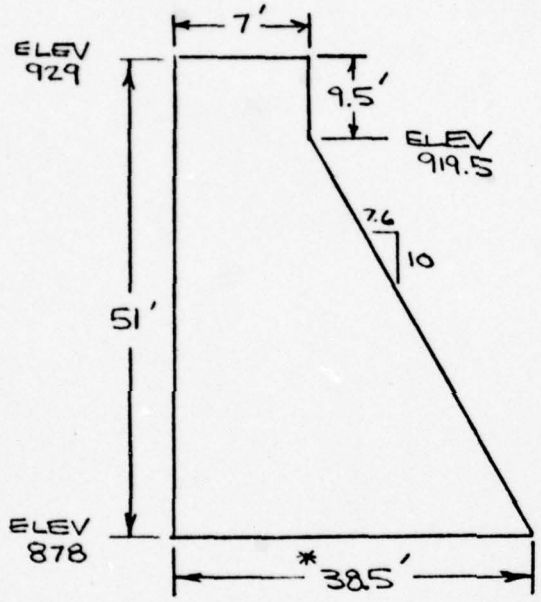
OVERTURNING

THE DAM WILL BE ANALYZED FOR OVERTURNING BY ASSUMING THE FOLLOWING CROSS SECTION:



NOTE: ALL ELEVATIONS AND DIMENSIONS ARE TAKEN FROM CONSTRUCTION DRAWING #17078 F6

TOP OF ROCK IS AT ELEV. 884 ON THE UPSTREAM SIDE OF THE DAM, BUT FOR THIS ANALYSES, HYDROSTATIC PRESSURE WILL BE ASSUMED TO EXTEND TO THE BOTTOM OF THE DAM AT ELEV. 878. THIS IS A MORE CONSERVATIVE ASSUMPTION.

* THIS NUMBER WAS OBTAINED BY ASSUMING THAT THE DOWNSTREAM SLOPE OF THE DAM FOLLOWS 7.6:10 SLOPE TO THE BASE THE DAM (CONSERVATIVE ASSUMPTION)

SUBJECT DAM SAFETY INSPECTION
ALCOA DAM

BY JTS DATE 6-7-78 PROJ. NO. 78-501-493

CHKD. BY JPN DATE 7-20-78 SHEET NO. 14 OF 19

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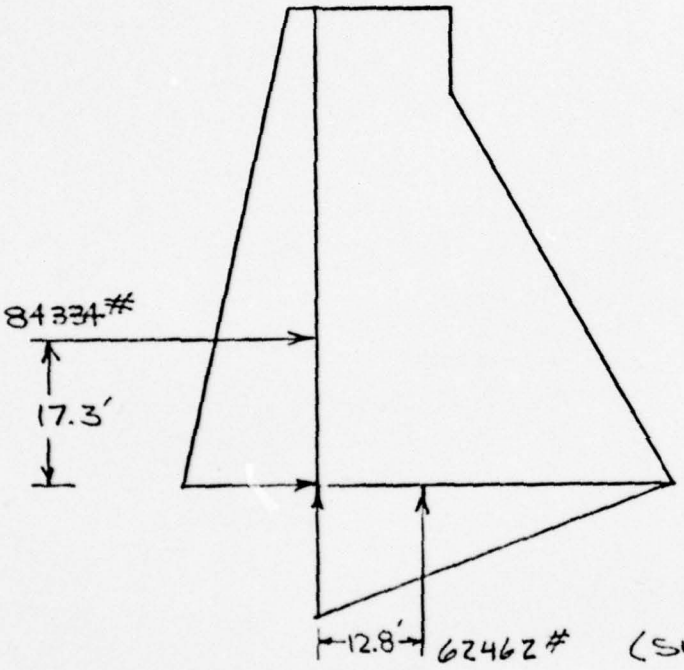
THE FOLLOWING DIAGRAM INDICATES HYDROSTATIC PRESSURES. NO TAILWATER IS ASSUMED. A 1.0' SECTION OF THE DAM WILL BE ANALYZED



(SHEET 15)

HYDROSTATIC FORCE ON FACE OF DAM

$$H = \gamma \frac{h_1 + h_2}{2} T = (62.4\,PCF)\left(\frac{1.0' + 52'}{2}\right)(51'X1.0') = 84334\#$$

POINT OF ACTION OF FORCE $\left(X = \frac{\Sigma M}{\Sigma A}\right)$

$$X = \frac{\left[(1.0)(51)(25.5) + \frac{(51)(51)}{2}(17)\right]}{\left[(1.0)(51) + \frac{(51)(51)}{2}\right]} = 17.3'$$

SUBJECT DAM SAFETY INSPECTION
ALCOA DAM

BY JTS DATE 6-7-78 PROJ. NO. 78-501-493

CHKD. BY DLB DATE 7-20-78 SHEET NO. 15 OF 19

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UPLIFT PRESSURE

$$U = \gamma \frac{h_1 + h_2}{2} T \qquad \text{(REF. 4, EQ. 8-2)}$$

T = BASE THICKNESS = 38.5'
h_1 = WATER DEPTH AT HEEL = 52'
h_2 = WATER DEPTH AT TOE = 0
γ = UNIT WEIGHT OF WATER = 62.4 PCF

$$U = (62.4 \text{ PCF})\left(\frac{52' + 0}{2}\right)(38.5')(1.0')$$

$$U = 62462^{\#}$$

UPLIFT ACTS AT $\frac{1}{3}T$ FROM THE HEEL OF THE DAM

$$\frac{1}{3}T = \frac{1}{3}(38.5') = 12.8'$$

REF 4: "WATER RESOURCES ENGINEERING"
LINSLEY AND FRANZINI, 1972, McGRAW-HILL

SUBJECT DAM SAFETY INSPECTION
ALCOA DAM

BY JTS DATE 6-7-78 PROJ. NO. 78-501-493

CHKD. BY DLB DATE 6-8-78 SHEET NO. 16 OF 19

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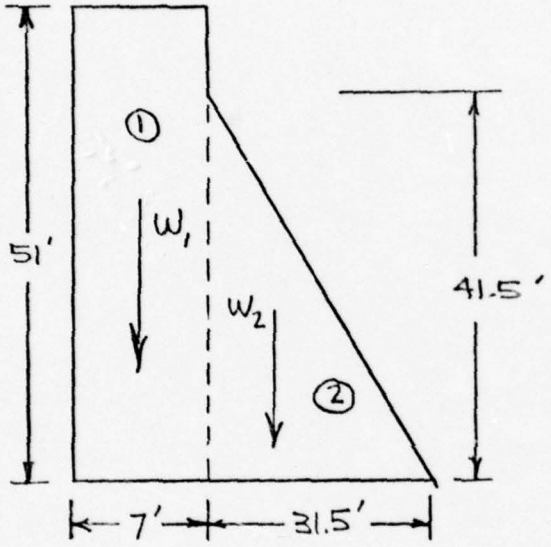
WEIGHT OF DAM

NOTE: ASSUME WEIGHT OF CONCRETE TO BE 150 PCF



SECTION ①

$$W_1 = \gamma hb = (150\ PCF)(51')(7')(1.0') = 53550\ \#$$

SECTION ②

$$W_2 = \gamma(\tfrac{1}{2}hb) = (150\ PCF)(\tfrac{1}{2})(41.5')(31.5') = 98044\ \#$$

SUBJECT DAM SAFETY INSPECTION
ALCOA DAM

BY JTS DATE 6-7-78 PROJ. NO. 78-501-493

CHKD. BY DLB DATE 7-20-78 SHEET NO. 17 OF 19

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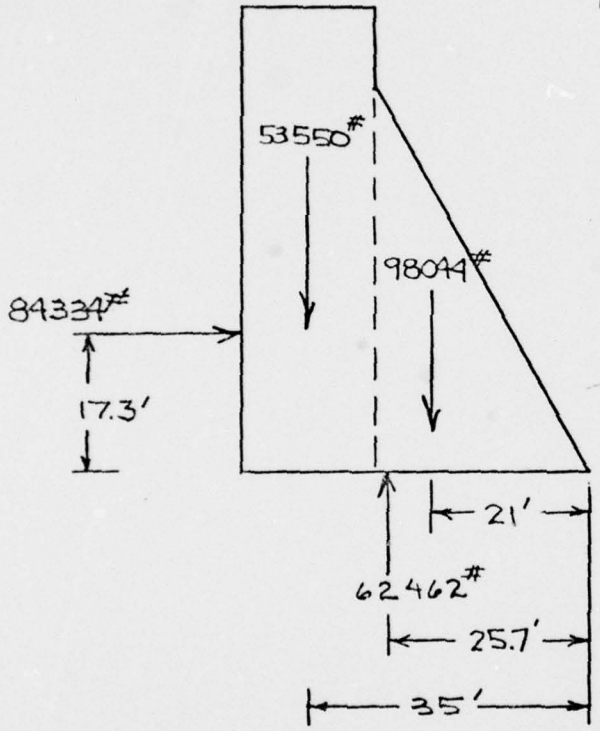
RESULTANT FORCES ON DAM

NOTE: ASSUME WEIGHT OF WATER FLOWING ATOP DAM TO BE INSIGNIFICANT



OVERTURNING MOMENTS (ΣM @ TOE)

$M_1 = (62462^{\#})(25.7') + (84334^{\#})(17.3') = 3,064,252$ FT-lb

RESISTING MOMENTS (ΣM @ TOE)

$M_2 = (98044^{\#})(21') + (53550^{\#})(35') = 3,933,174$ FT-lb

SUBJECT DAM SAFETY INSPECTION
ALCOA DAM

BY JTS DATE 6-7-78 PROJ. NO. 78-501-493

CHKD. BY DLB DATE 7-20-78 SHEET NO. 18 OF 19

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FACTOR OF SAFETY AGAINST OVERTURNING

$$F.S. = \frac{\text{RESISTING MOMENTS}}{\text{OVERTURNING MOMENTS}}$$

$$F.S. = \frac{3,933,174 \text{ FT-lb}}{3,064,252 \text{ FT-lb}} = 1.28$$

SUBJECT DAM SAFETY INSPECTION
ALCOA DAM

BY DLB DATE 6-15-78 PROJ. NO. 78-501-493

CHKD. BY JPN DATE 7-20-78 SHEET NO. 19 OF 19

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SLIDING

THE DAM WILL BE ANALYZED FOR SLIDING BY ASSUMING THE SAME CONDITIONS AND CROSS SECTION THAT WERE ASSUMED FOR OVERTURNING

FORCE INDUCING SLIDING

HYDROSTATIC FORCE = 84334 Lb (SHEET 14)

FORCE RESISTING SLIDING

FRICTION = $\mu (W - U) = F_f$

(REF. 5, P. 295) μ = FRICTION FACTOR = (0.75)
(SHEET 16) W = WGT OF CONCRETE = (98044 + 53550) Lbs
= 151,594 Lbs
(SHEET 15) U = UPLIFT = 62,462 Lbs

$F_f = 0.75 (151,594 - 62,462) = 66,849$ Lbs

FACTOR OF SAFETY = $\frac{\Sigma F_F}{\Sigma H_A} = \frac{66,849}{84,334} = 0.79$

REF. 5: "ENGINEERING FOR DAMS"
JULIAN HINDS, 1945, WILEY & SONS

APPENDIX D

PHOTOGRAPHS

PHOTOGRAPH 1 View looking toward the left abutment from the right end of the spillway as it appeared in August 1943. Note the grout pipes along the centerline of the foundation

PHOTOGRAPH 2 View looking toward the right abutment showing the right end of the spillway.

PHOTOGRAPH 3 View looking along the centerline of the dam toward the right abutment as it appeared in 1943.

1

2

3

PHOTOGRAPH 4 View of the Alcoa Dam taken from an area a few hundred feet north of the right abutment. A field team member is shown near the center of the photo as scale.

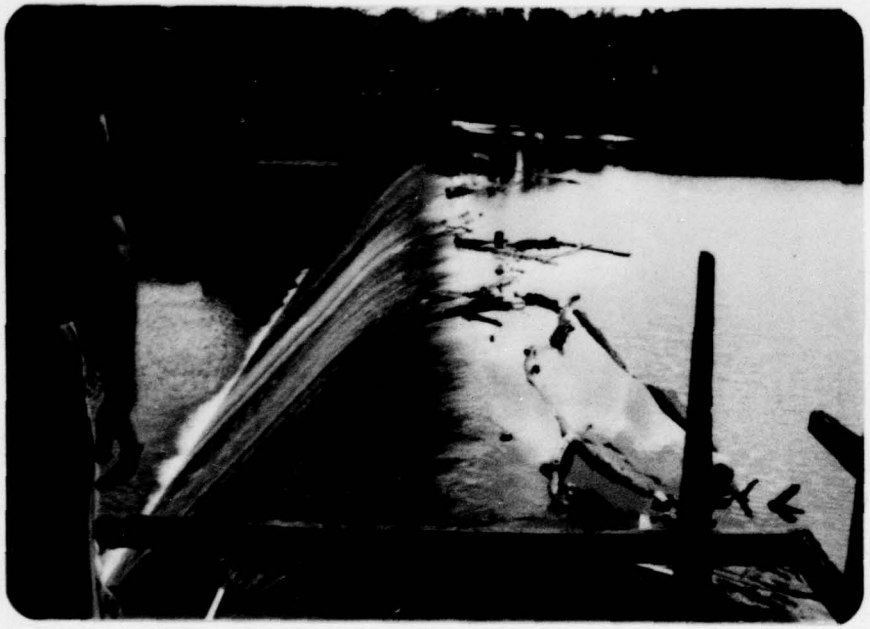
PHOTOGRAPH 5 View of the upstream portion of Alcoa Dam from the area just upstream of the right abutment. The concrete protuberance just to the right of the spillway side wall is thought to be an old sluice gate.

PHOTOGRAPH 6 Close-up view of the Alcoa Dam spillway showing the debris which has accumulated at the approach to the ogee spillway.

PHOTOGRAPH 7 View of an area of seepage (shown by the heavily vegetated area) near the right center portion of the structure. At the time of inspection it appeared that most of the seepage was issuing from beneath the structure and not through the construction joints as might be inferred from the efflorescence shown near the center of the photograph. The brick structure to the right is a pumphouse.

4

5



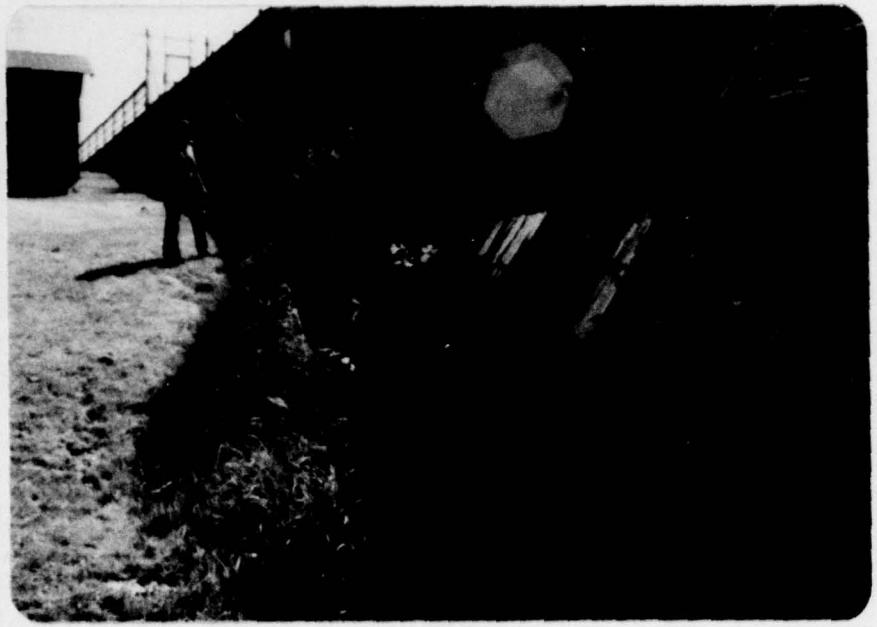
6

7

PHOTOGRAPH 8 Close-up view of the area of seepage referred to in the previous photograph. A small amount of seepage was observed to be passing through horizontal construction joint near the center of the photograph. Note the standing water in the lower left portion of the photograph.

PHOTOGRAPH 9 View of the Alcoa Dam spillway and the channel just downstream of the dam.

PHOTOGRAPH 10 View looking upstream at the first improvement directly downstream of Alcoa Dam. It is a two-lane bridge located approximately 1,000 feet downstream of the dam. Two dwellings are located about 400 feet northeast of the bridge which have first floor elevations less than 7 feet above the bridge deck.



8

9

10

APPENDIX E

GEOLOGY

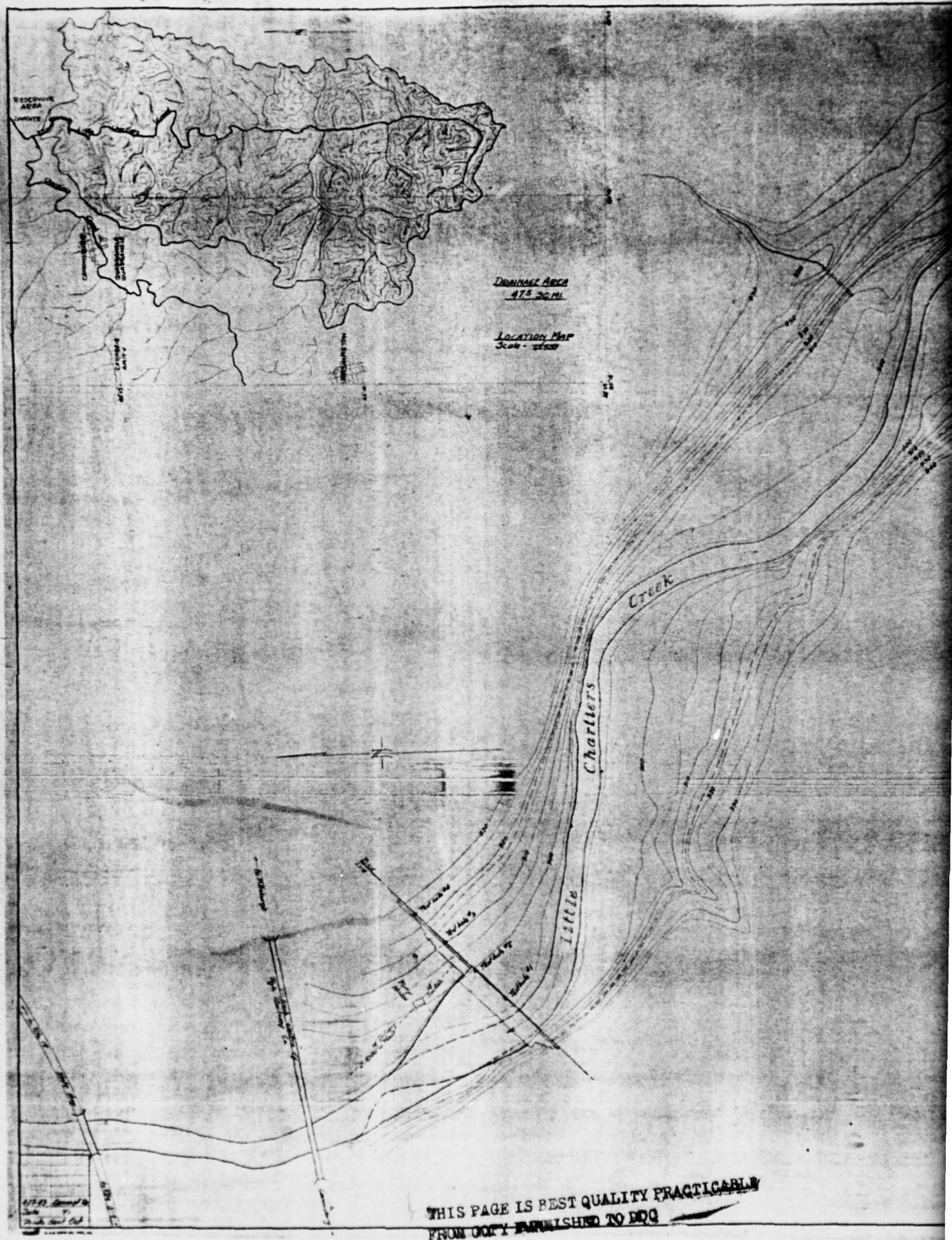
Alcoa Dam is located in an area of nearly flat lying sedimentary rocks of the Pennsylvanian age, Monongahela Group. These rocks are characterized as dense and massive to thin bedded limestone, discontinuous shales, and sandstones. Numerous minable coal seams are also found within this group.

Alcoa Dam is founded on a dark shale unit which directly overlies the Uniontown Limestone. Details of the subsurface geology are shown on the attached Figure 2.

APPENDIX F

FIGURES

LIST OF FIGURES



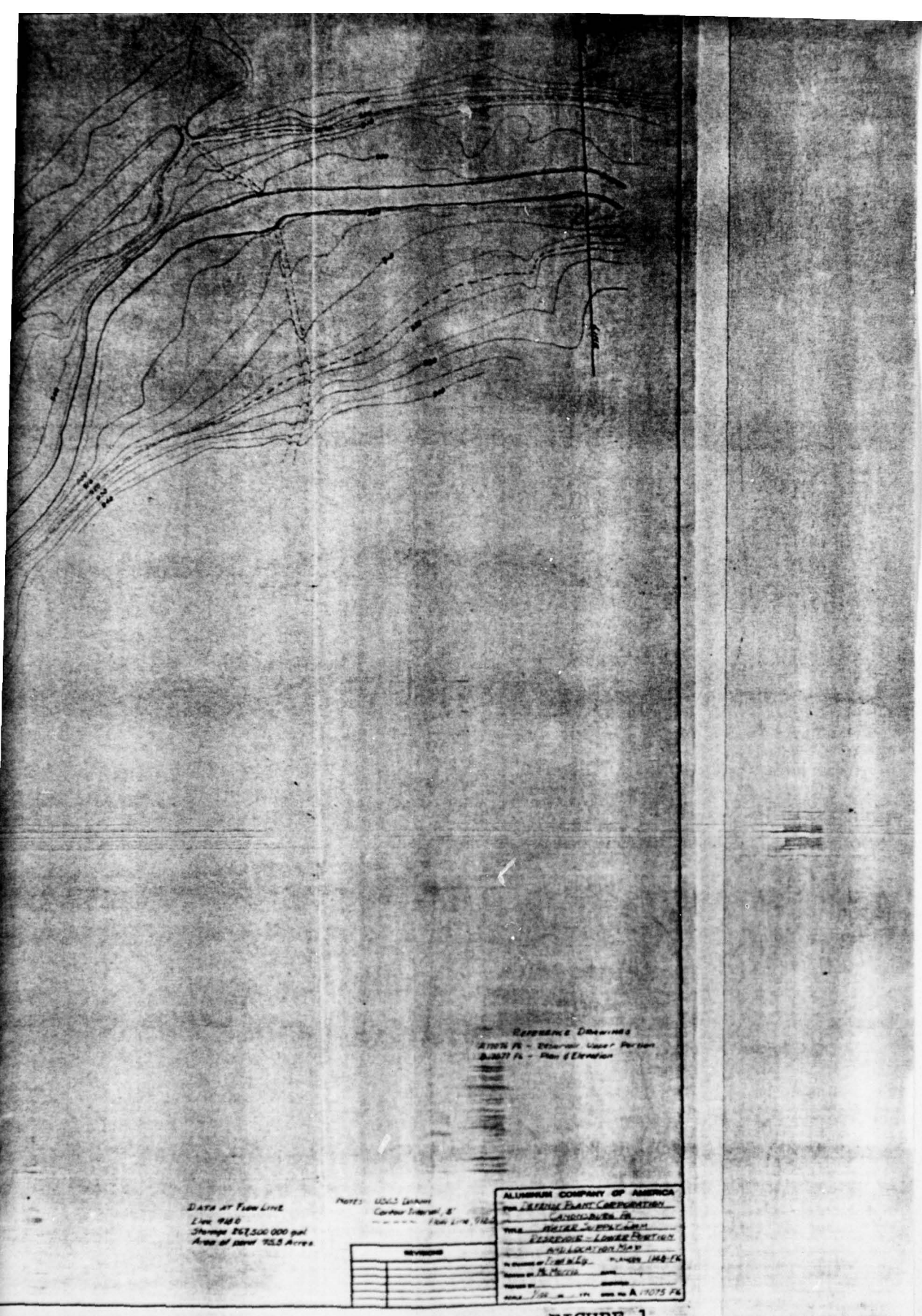
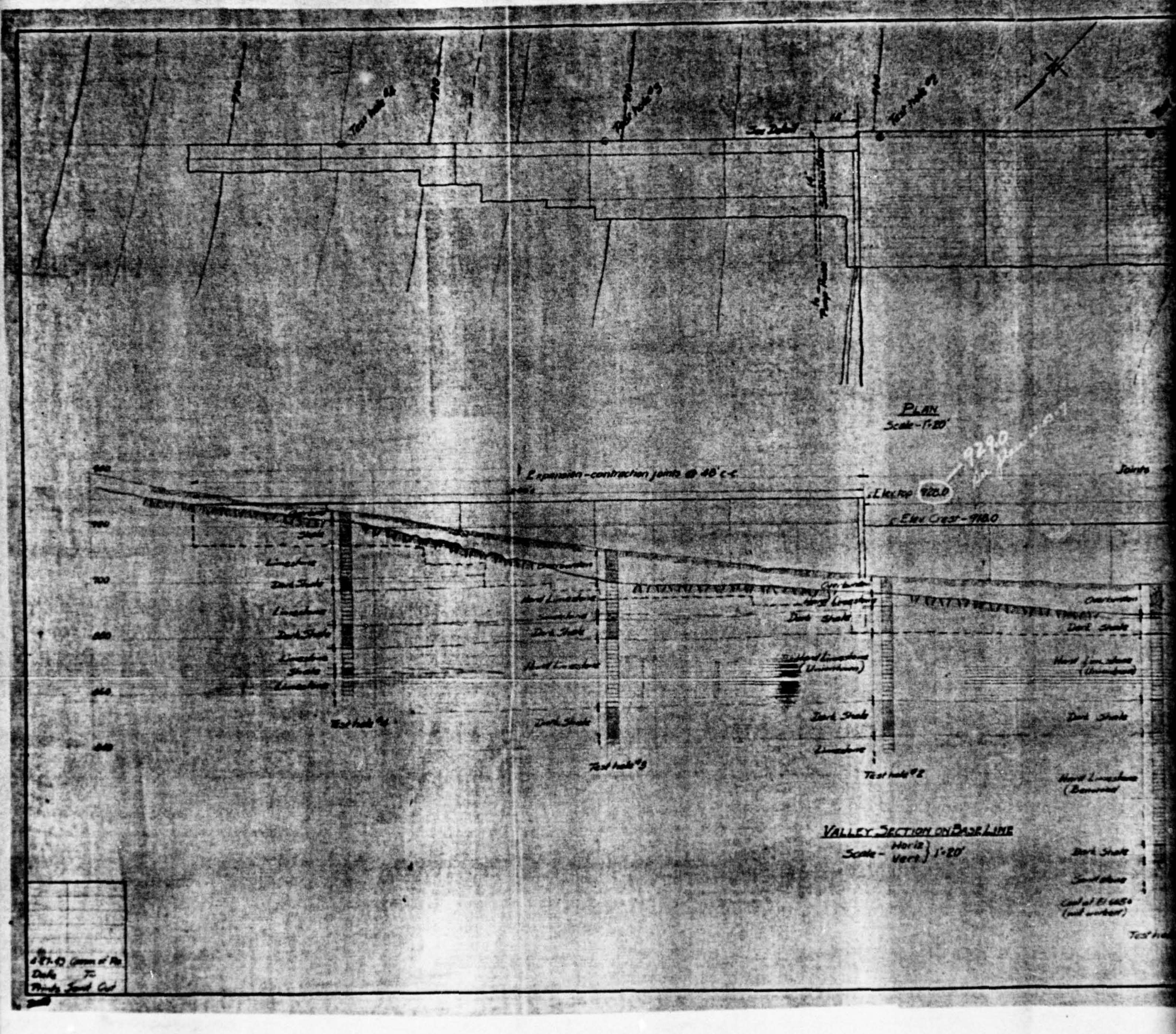

Reference Drawings
Data at Flow Line
Line 918
Storage 267,500,000 gal
Area at zone 155.5 Acres
Notes: USGS Datum
Contour Interval, 5'
ALUMINUM COMPANY OF AMERICA
for Defense Plant Corporation
Cantonsville, Md.
Water Supply System
Reservoir - Lower Portion
and Location Map

FIGURE 1



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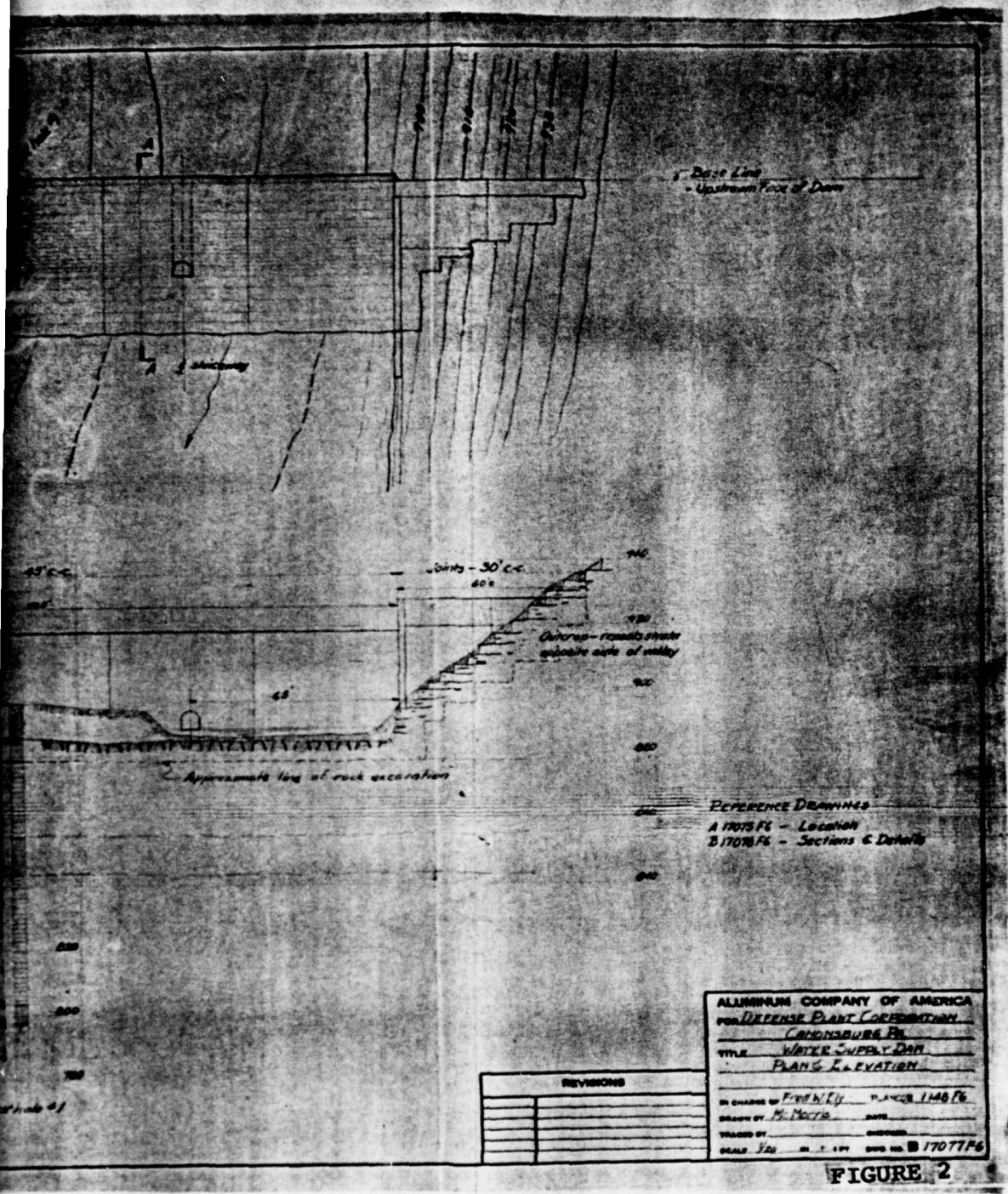
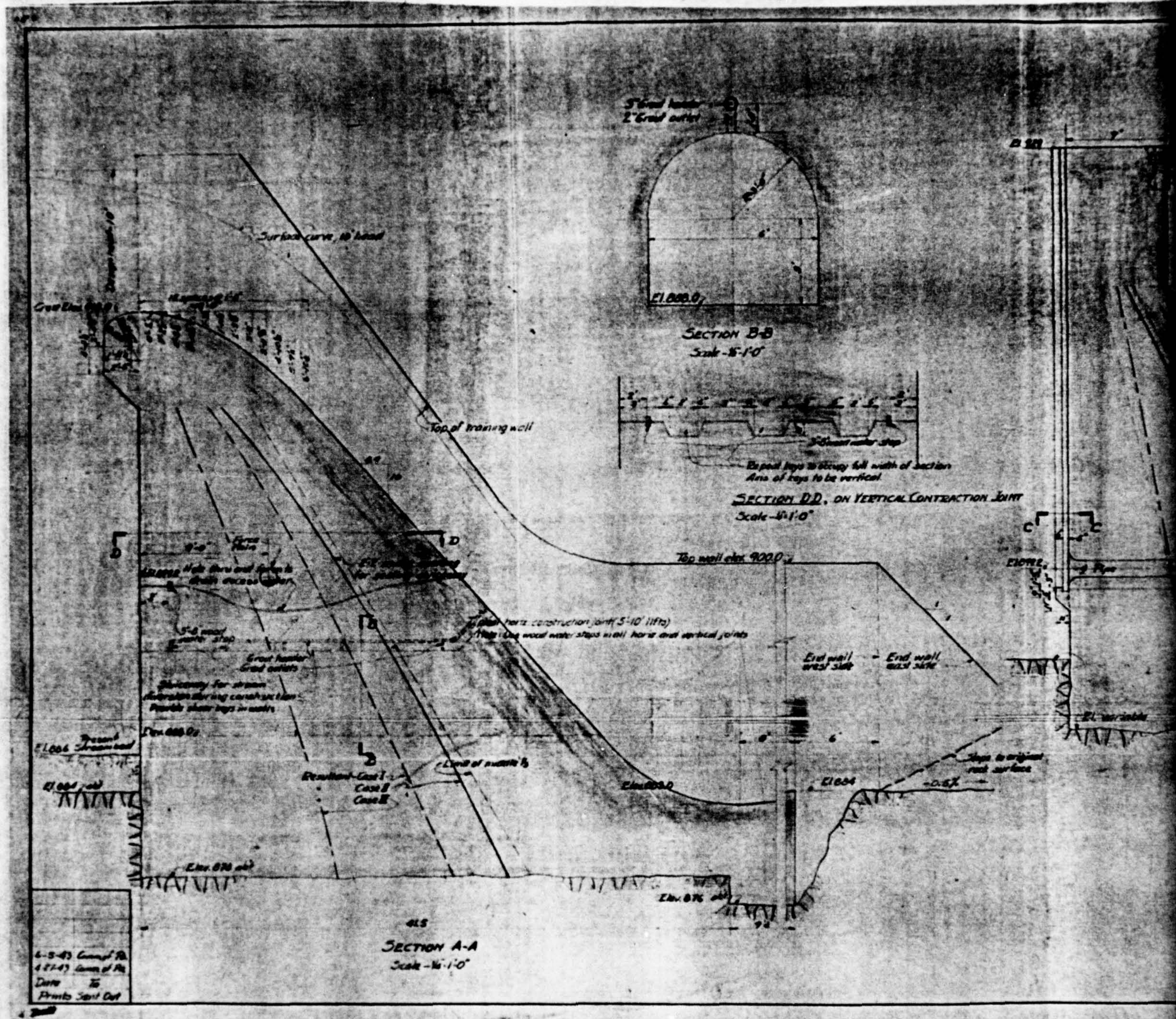

Base Line
- Upstream Face of Dam
Joints - 30° c.c.
Outcrop - remains strata opposite side of valley
Approximate line of rock excavation
REFERENCE DRAWINGS
A 17073 F6 - Location
B 17078 F6 - Sections & Details
ALUMINUM COMPANY OF AMERICA
FOR DEFENSE PLANT CORPORATION
CANONSBURG, PA.
WATER SUPPLY DAM
PLANS & ELEVATION
REVISIONS
DRAWN BY M. Morris
SCALE 1/24
DWG NO. B 17077 F6

FIGURE 2



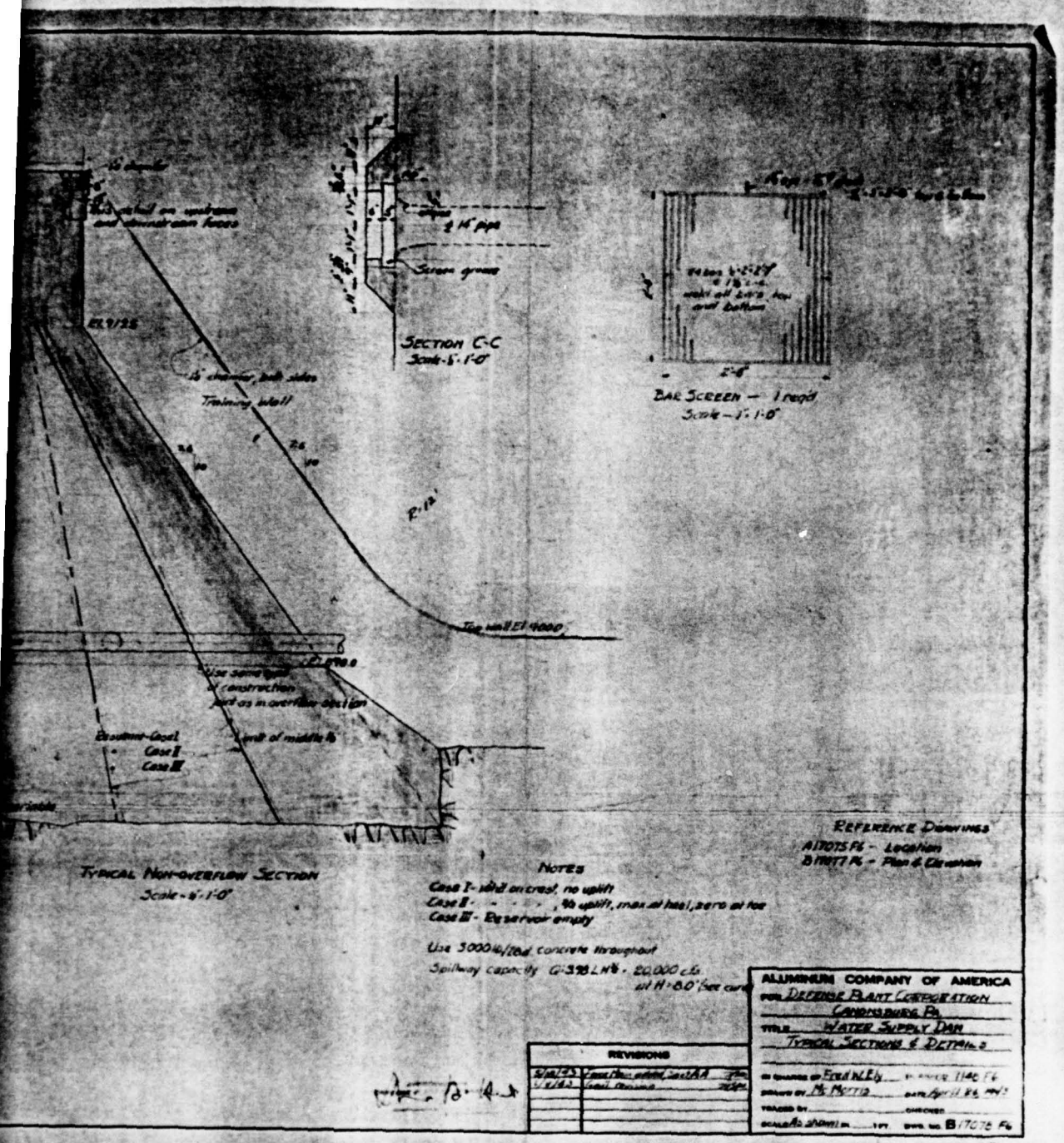
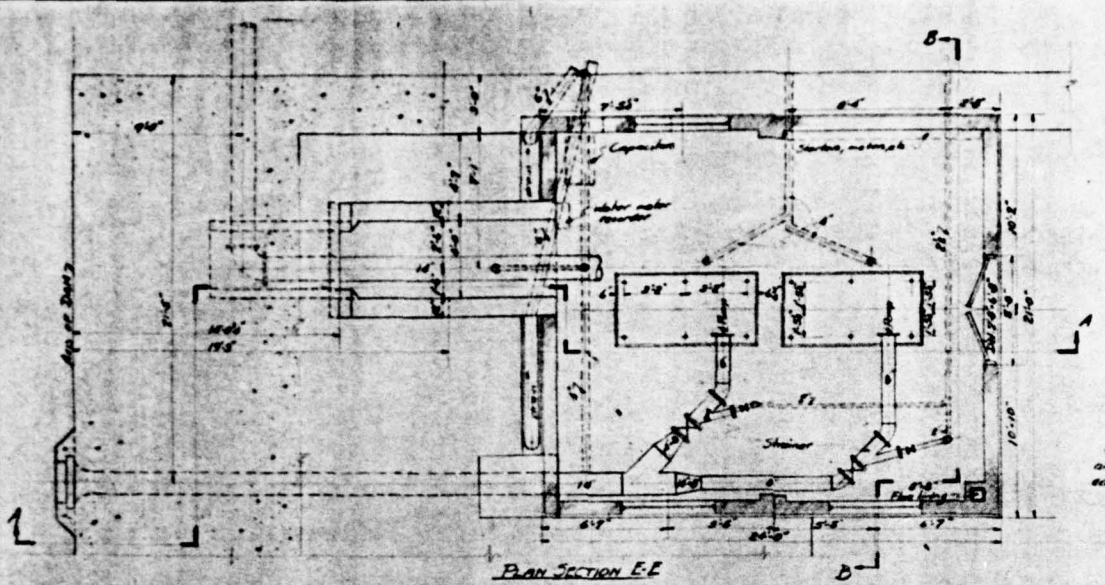
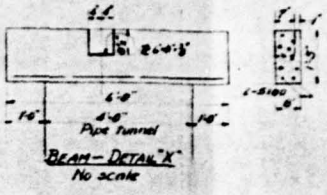


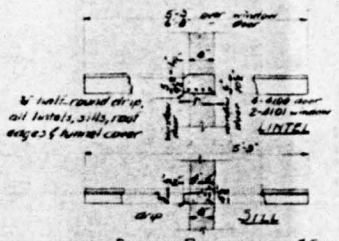
FIGURE 3



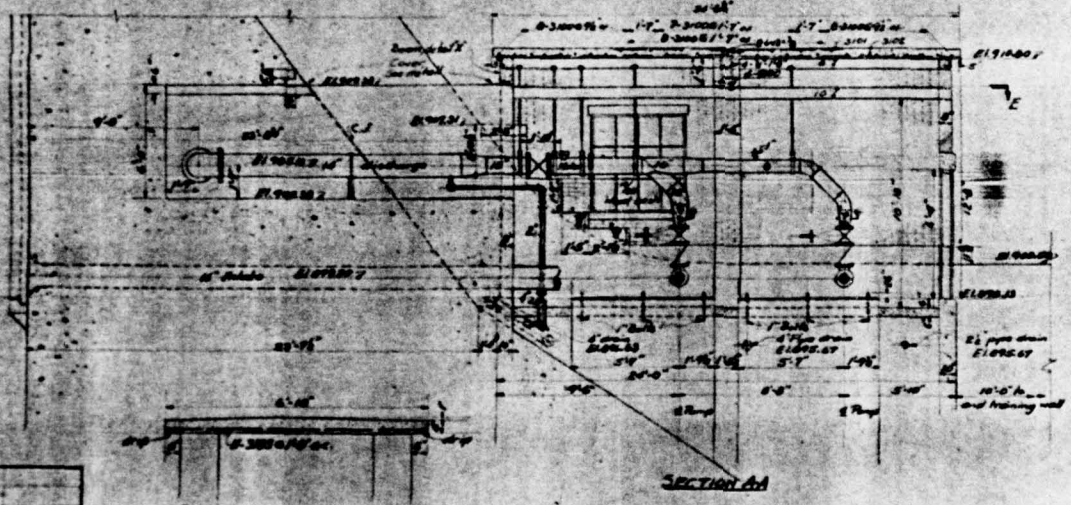
PLAN SECTION E-E



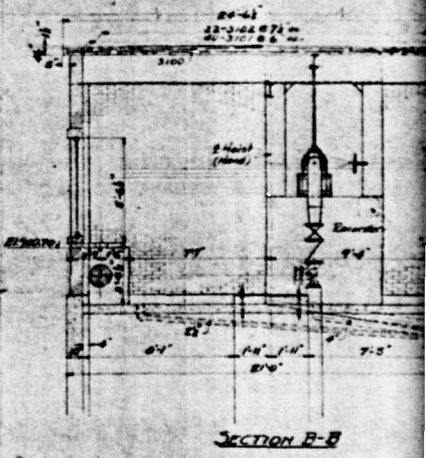
BEAM - DETAIL "X"
No scale



DETAILS - PRECAST LINTEL & SILL
No scale



SECTION A-A



SECTION B-B

DETAIL - PIPE TUNNEL COVER
No scale

PUMP HOUSE
Scale - 1/4"-1'0"

Date
Prints Sent Out

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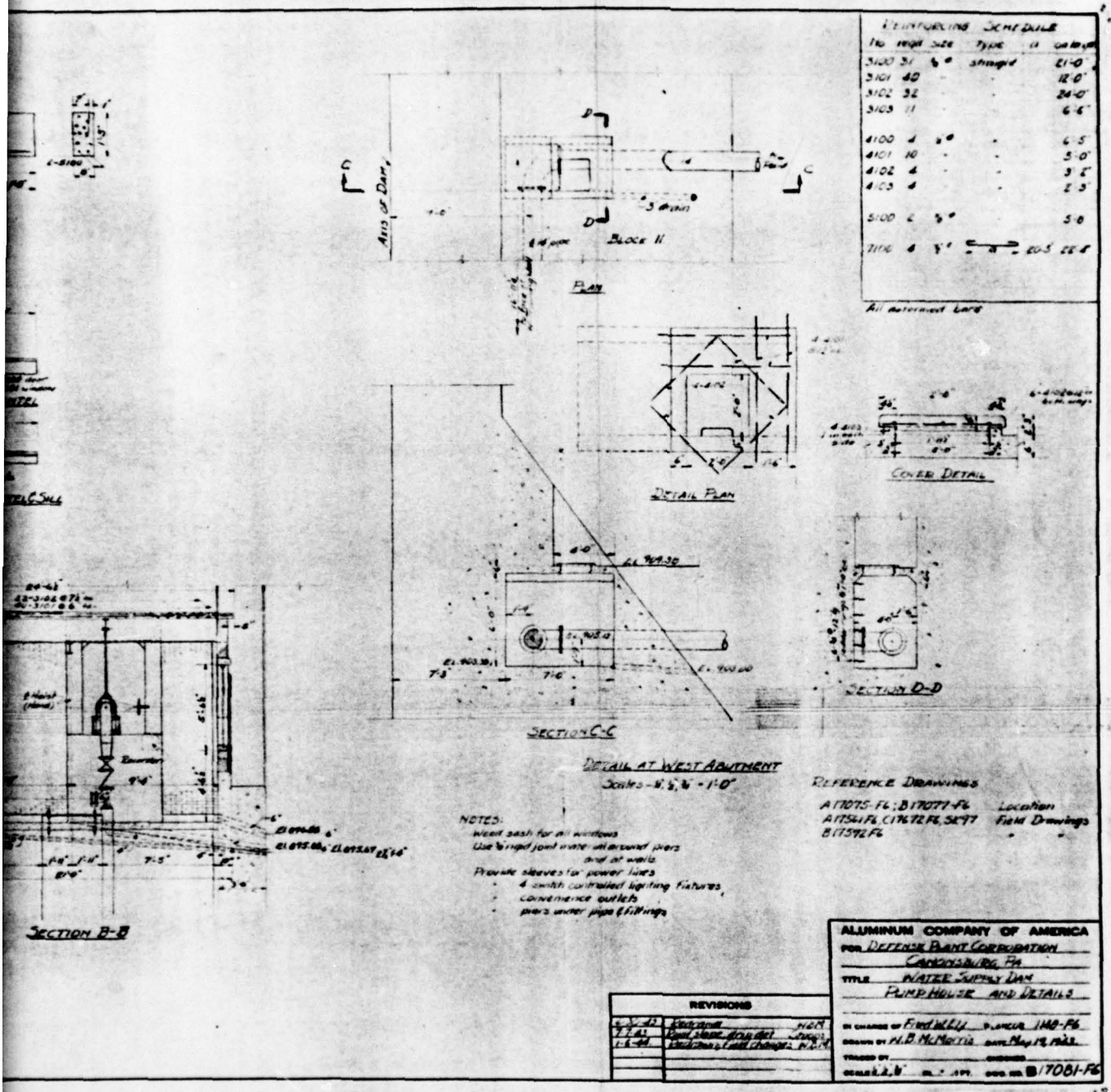
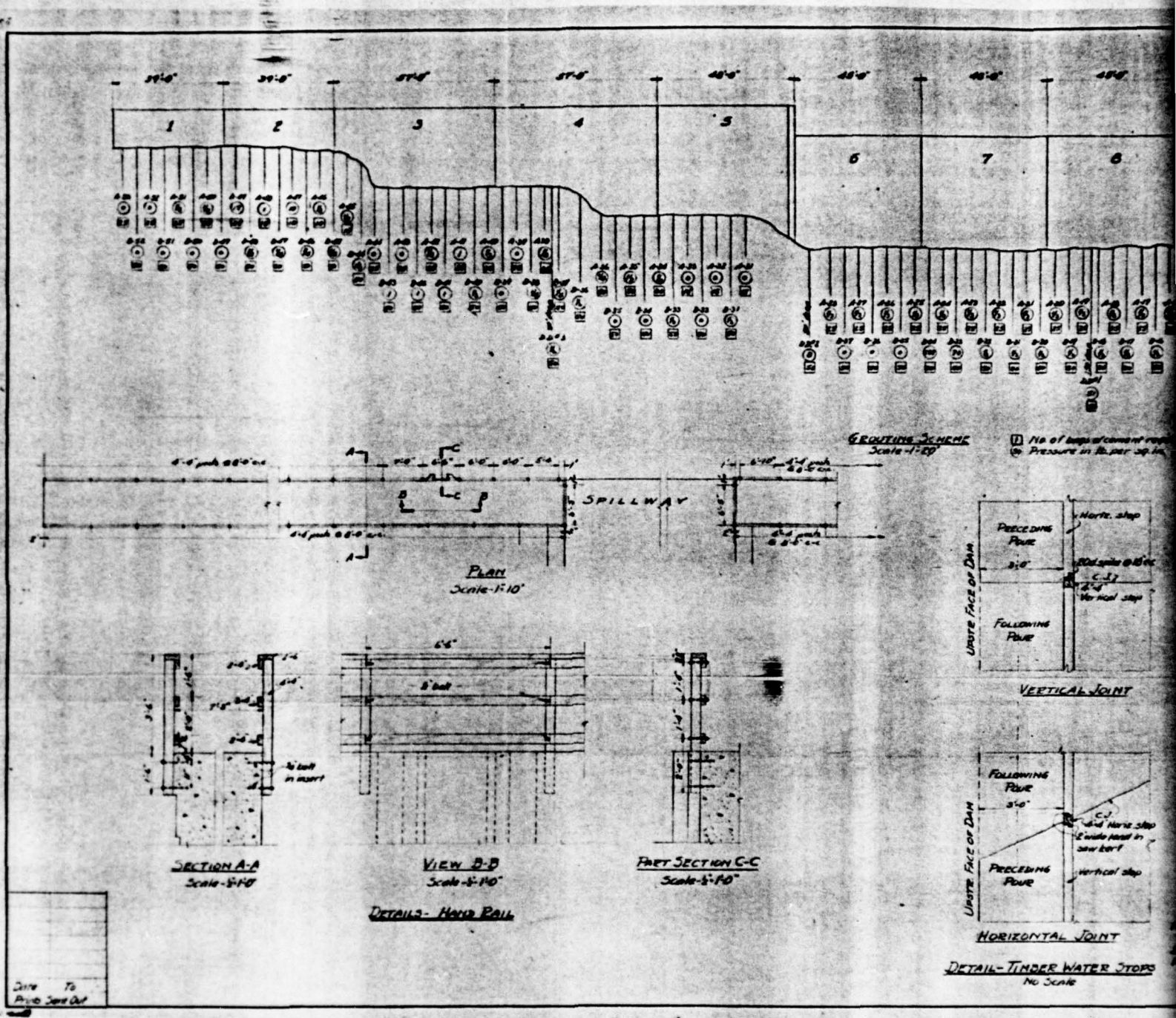

REINFORCING STEEL SCHEDULE
All reinforcing bars
Axis of Dam
Block II
PLAN
DETAIL PLAN
COVER DETAIL
SECTION C-C
SECTION D-D
SECTION B-B
Detail at West Abutment
Scales - 1/2", 1/4" - 1'-0"
NOTES:
Weld sash for all windows
Use 1/2 rigid joint waterstop around piers and at walls
Provide sleeves for power lines
4 switch controlled lighting fixtures,
convenience outlets
piers under pipe & fill rings
REFERENCE DRAWINGS
A 17075-F6; B 17077-F6
A 17541-F6, C 17672-F6, SK 97
B 17592-F6
Location
Field Drawings
ALUMINUM COMPANY OF AMERICA
FOR DEFENSE PLANT CORPORATION
CASCADE, PA
TITLE WATER SUPPLY DAM
PUMP HOUSE AND DETAILS
REVISIONS
B 17081-F6

FIGURE 4



2

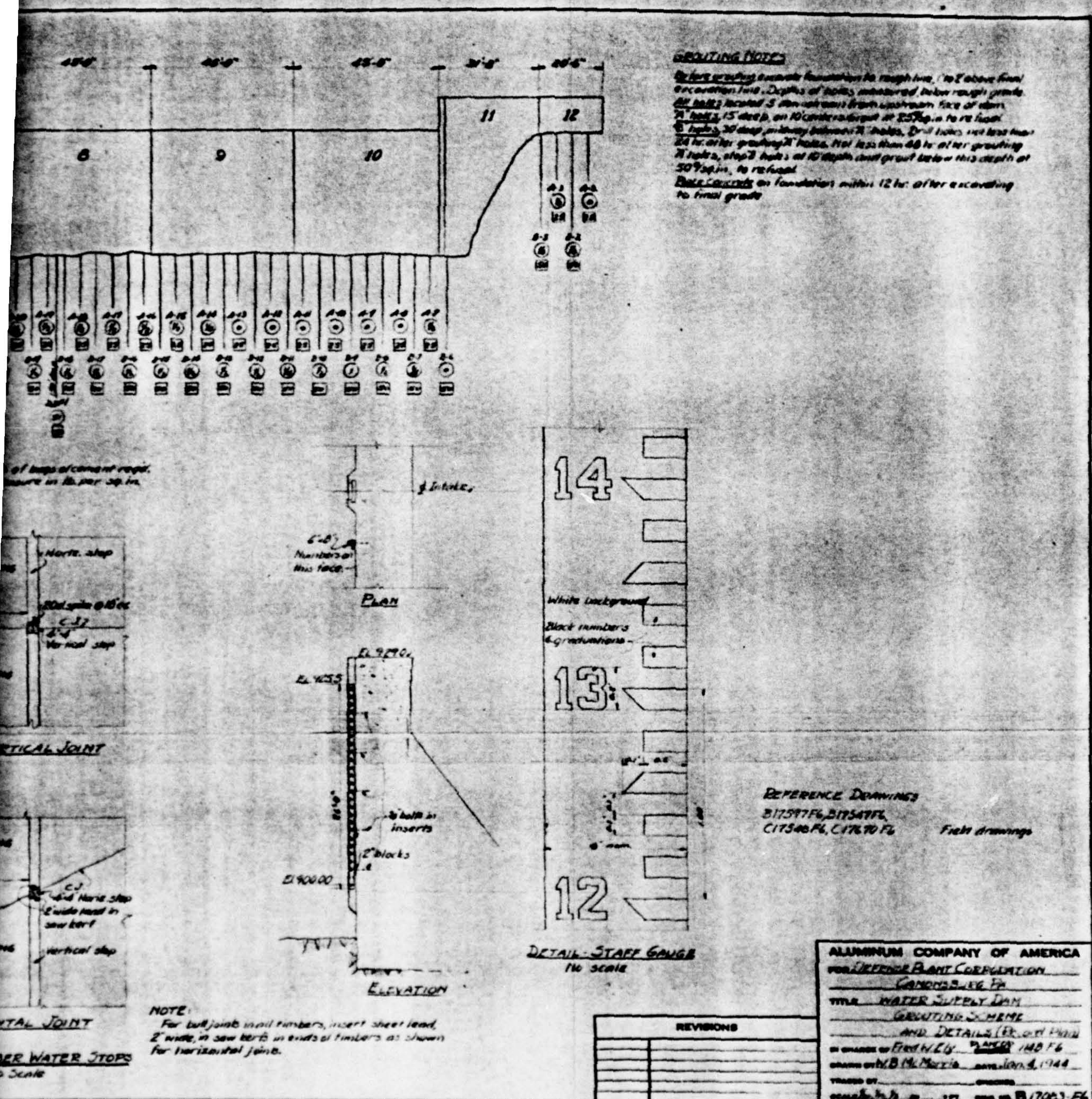

GROUTING NOTES
White background
Black numbers & graduations
PLAN
ELEVATION
DETAIL - STAFF GAUGE
REFERENCE DRAWINGS
Field drawings
REVISIONS
ALUMINUM COMPANY OF AMERICA
FOR DEFENSE PLANT CORPORATION
TITLE WATER SUPPLY DAM
GROUTING SCHEME
B 17063-F6

FIGURE 5

APPENDIX G

REGIONAL VICINITY MAP


Alcoa Dam
Hendersonville
Sch
Cool Valley
Morganza Reservoir
Reservoir
STATE TRAINING SCHOOL
Morganza
Murry Hill
Hist or
Van Emman
Donaldsons Crossroads
Canonsburg
Greer Pond
Monitour Creek
Chartiers Creek
Penn Central
Van Emmans Ponds
Pipeline
Mine Dump
Oil Wells
Oil Well
Water
Substation
Quarry
Airway Beacon
Drive-in Theaters
Filtration Plant
Weavertown
Borland Manor
Township Sch
NORTH STRABANE
CANONSBURG, PA.
SW/4 CARNEGIE 15' QUADRANGLE
N4015—W8007.5/7.5